February 1961

Electrical South

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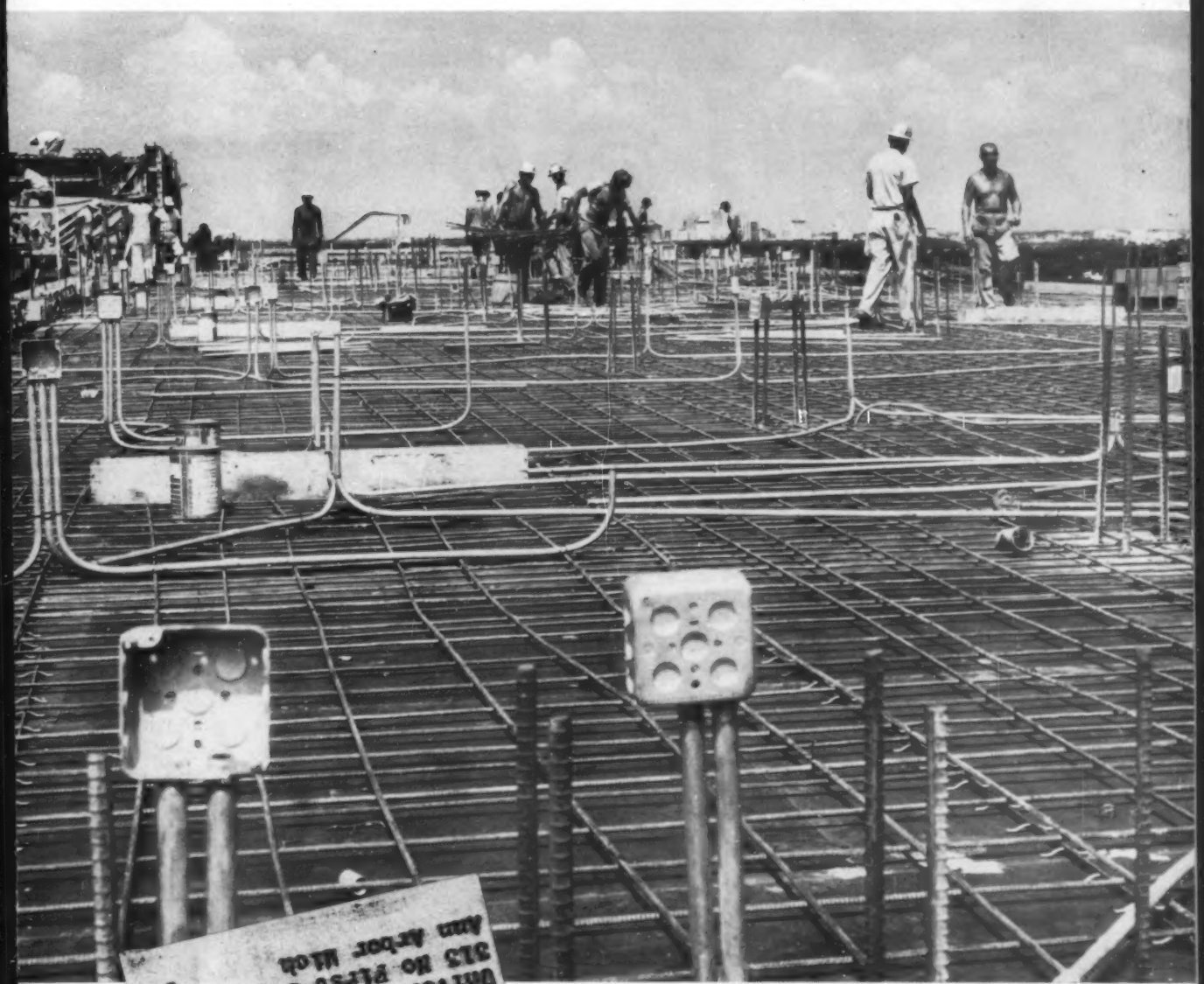

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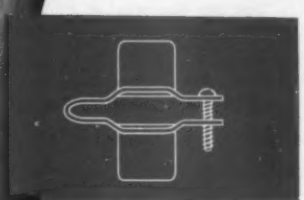

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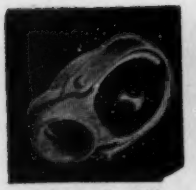
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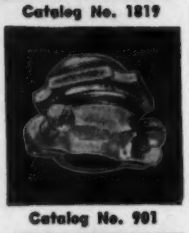
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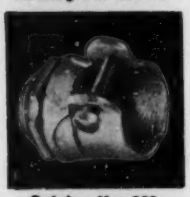
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ELECTRICAL SOUTH is published monthly at 116 E. Crawford Street, Dalton, Georgia by W. R. C. Smith Publishing Company. Executive and Editorial Offices: 806 Peachtree Street, N. E. Atlanta 8, Georgia. Second-class postage paid at Dalton, Georgia. Postmaster, send notices by Form 3579 to 806 Peachtree St., N.E., Atlanta 8, Ga.

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Economic comment

by J. Whitney Bunting, Ph.D.
Contributing Economics Editor

Unanswered questions

The new year will bring many questions in the area of economics, many of which cannot be answered until the test of time.

One thing is certain, however, and that is the fact that government spending will undoubtedly be on the increase, in spite of the appointment of Douglas Dillon as Secretary of the Treasury.

When the news of Mr. Dillon's selection first became public, there was great optimism in many circles that he would be able to control runaway spending as well as increased inflation. His record in the field of finance as well as his experiences with the Eisenhower administration sincerely indicated a conservative and sound approach to government fiscal affairs.

In fact, his appointment purportedly touched off some ill will in high Republican circles that his position would diminish the opposition party's chief argument against the new Administration; that of unsound financial operations. Recent events lead us to believe that in spite of Mr. Dillon there will be plenty of spending to criticize in the months ahead.

Mr. Kennedy has approached the problems of government in extreme thoroughgoing fashion by the appointment of a series of task forces to look into basic political-economic questions so that reports might be prepared in relation to background matters, potential influences, and action programs to correct conditions. Many of these reports dealing with such matters as unemployment and depressed areas, old age, educational support, gold flow, and others have now been finished and released to public view.

Quest for fiscal stability

In spite of the fact that these studies have been handled in a most scholarly fashion and have reached deep into the causes of the problems cited, all have uniformly indicated a most serious emphasis upon heavy governmental expenditures. The sum total of the actions recommended by these reports is well into the billions of dollars; and the feeling is that if these corrective measures are carried out completely, the financial estimates are minimal.

One of the major objectives of the Federal Government during the past eight years has been fiscal stability, involving among other factors no unnecessary spending, strict inflationary controls, balanced budget, and the stability of the dollar. Such a program, valuable as it may be to the nation as a whole, is often unpopular to certain segments of our society.

For example, in two areas in particular, there has been strong opposition to any attempt to tighten the governmental purse strings. National educational groups and representatives of depressed economic areas have waged strong battles to overcome government reluctance to undertake strong financial spending programs for the specific aid requested. The balanced budget as proposed by President Eisenhower a few weeks ago had limited provisions in these two categories.

As a result, any increase in financial aid to education or to those regions and communities with heavy unemployment will require some deficit spending. A decision must be made quite promptly as to the financial path this nation will follow during the next four years.

The question of the necessity of federal spending to overcome current recessionary tendencies in the economy has not been solved as of the present moment. Economists and business leaders seem to be divided in their interpretation of both the severity of present conditions and the direction of movement of the economy.

The new officials in Washington will have a serious decision to make for there are many indications that the economy is strong and vigorous with only localized spots of depressed conditions. If this is the case, federal economic action is not called for on any broad front.

In fact, heavy deficit spending might well further depress conditions, thus increasing the severity of present conditions. The soundness of the American economy is dependent upon the stability of finance, industry, trade, and above all the confidence of the people who comprise the nation itself.

Government's role

One item that each citizen should consider most thoroughly in the days ahead is the place of government in the economic scene. How much activity should federal agencies take in the day-to-day operation of business? This is a question with which everyone must come to grips for it is the basis of the national economic system.

Free enterprise, so important to the American way of life, depends upon the individual contribution of every citizen to the productivity of the nation. The healthiest economy is the one where the greatest freedom to produce is provided to all. The direction that the economy takes is controlled, under this system, by the votes of consumers in the market place.

The substitution of government action for this free choice of the people undermines the entire framework of the present economic system. Moreover, it tends to diminish the control that each person has over the type of goods produced, the quantity of goods produced and offered for sale, and the price at which such goods are sold. This freedom of choice in the market place should be one of the most treasured rewards for the continuation of the present economy.

Prerogatives may be lost

A movement away from this traditional economic system can be very slight but can pick up headway when people indicate that they are willing to relinquish their power to others, either governmental or private. It is historic fact that once such concessions are made, they are truly difficult to ever regain.

Consequently, every citizen should think this problem through

(Continued on page 114)

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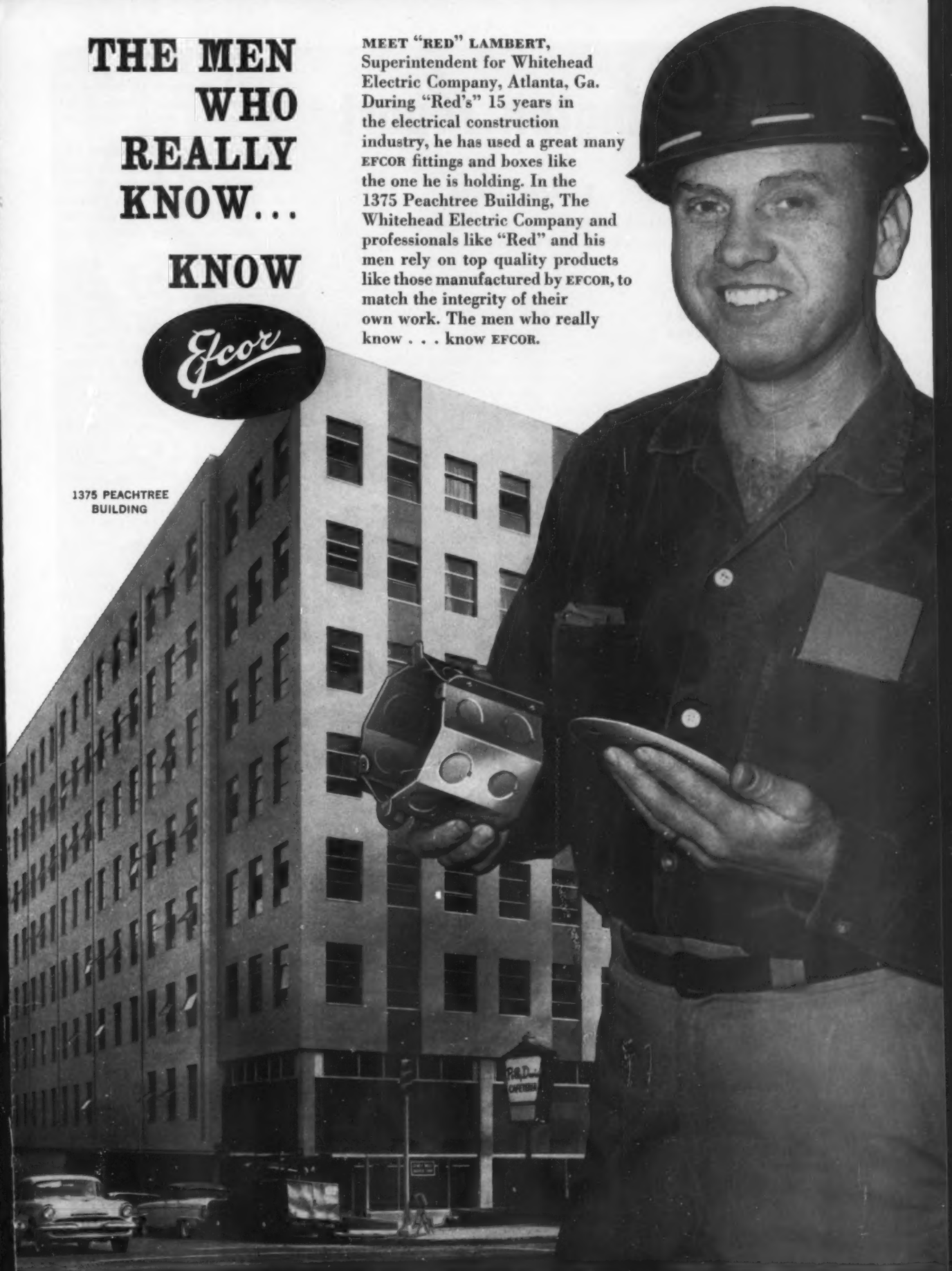

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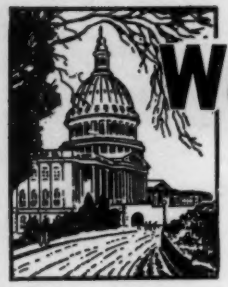

Washington report

By Jack James

Digest of Washington news of special significance to the electrical industry

$5.5 billion in bond sales forecasts building pickup

SOME $5.5 BILLION in bond sales in 1960 indicate that state and local community construction will pick up in the years ahead, the U. S. Department of Commerce reports.

The bond approvals during the November election hit a record high, the Department reports.

But because of the time lag between voter approval and the start of construction, 1961 construction activities will largely reflect bond sales during the 1950's. Weight of the heavy 1960 bond sales won't be felt until 1962.

The Department expects a five per cent increase in state and local government construction activity in 1961.

Post-dated checks assist with uncertain purchases

HERE'S A TIP on checking that you might want to check with your lawyer before using. In many states when buying from questionable sources or paying for something you expect to receive, a post-dated check will protect you. If you revoke the transaction and stop payment on the check before it becomes due, you can get excellent legal protection in cases that you might otherwise lose.

Committee to investigate stoppages in missile work

DESPITE SIGNS that both labor union headquarters, government agencies, and the armed forces started cracking down on missile base work stoppages, Sen. McClellan (D-Ark.) announced that his rackets committee will hold hearings. The Senator has ordered a full-scale investigation.

Facts are fairly well known. For example, of the 96 strikes between July 1, 1959, and June 31, 1960, about 80 appear to have been wildcat strikes that violated either the contract or the law. This amounted to one strike every four days at missile bases. Since June, the rate seems to have dropped as both international union headquarters and three or four Washngton agencies descended on every wildcatting local union.

In the South, electrical contractors have been hit by strikes at Cape Canaveral and at the Redstone Arsenal in Huntsville, Ala.

One fact to which Sen. McClellan's investigation undoubtedly will give national publicity is this: a strike against an electrical contractor, for example, is aimed more at the government than at the contractor. By striking or threatening to strike, unions force the government to pressure contractors to meet union demands. It is a form of blackmail.

The missile construction program is months behind schedule. The nation cannot afford to let it lag another day. So the strike hits where it hurts.

Georgia co-op must stop action made against union

THE NATIONAL LABOR Relations Board at Washington ordered the Satilla Rural Electric Membership Corp., a cooperative with headquarters at Alma, Ga., to stop discriminating against the IBEW.

Facts of the case, according to the board report, are these:

After the IBEW began organizing the co-op's 55 employees, all 41 employees at the Alma office signed union cards. (The report does not state whether the other employees in the branch offices signed.)

Then the manager of the co-op prepared cards addressed to the union. These cards stated that the signer was withdrawing his application for membership in the union and did not desire anything further to do with the union.

The operations supervisor handed the cards to the employees. They were returned to him after having been signed. Forty of the 41 employees at Alma signed the withdrawal cards.

Despite testimony by eight employees that they signed the cards voluntarily and were not threatened, the board held that the co-op's requesting them to sign the cards was an unfair labor practice.

The board, however, found that the company acted within the law in granting wage increases during this period of conflict with the union. The co-op was reorganizing job classifications following a pattern recommended by the National Rural Electrification Cooperative Association to which it belongs.

The Satilla co-op serves 13,000 customers with 3,800 miles of line. Besides the Alma headquarters, there are offices at Jesup, Hazelhurst, and Douglas, Ga.

Unemployment at highest since depression of 30's

WHEN JACK KENNEDY was inaugurated President last month, some 5.5 million people were unemployed. As you read this, it's a virtual certainty that some six million are unemployed, the most since the depression of the 1930's.

FTC hits corporations using false advertising

THE FEDERAL Trade Commission charged that Dialand Electric Sales Corporation (which does business as Diamond Electric Co.) and Elkee Corporation advertised as their own products plastic electrical tape and solderless service connectors which actually were made in Japan.

Markings on packages also mislead purchasers, the FTC said. The two firms are affiliated.

Internal Revenue Service has reward for informers

REP. JOHN TABER, (R-N. Y.) calls the Internal Revenue Service's practice of rewarding tax informers "an abominable and un-American institution."

Despite Rep. Taber, the IRS paid employees, housewives, friends, and neighbors who give tips $522,607 last year. For this small investment, the IRS recovered $12 million in taxes, penalties, and interest. Informers can get as much as ten per cent of what is recovered.

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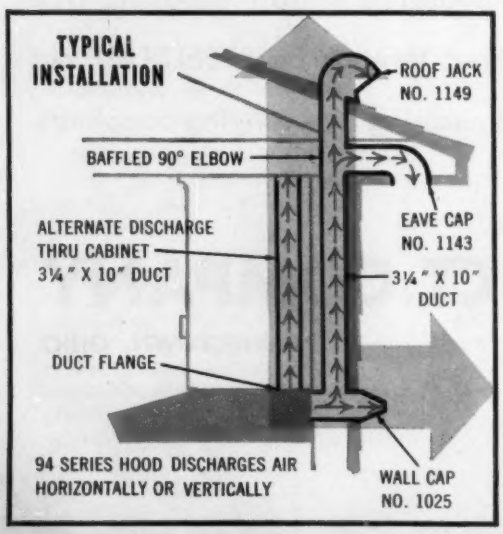
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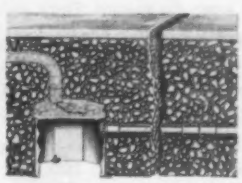

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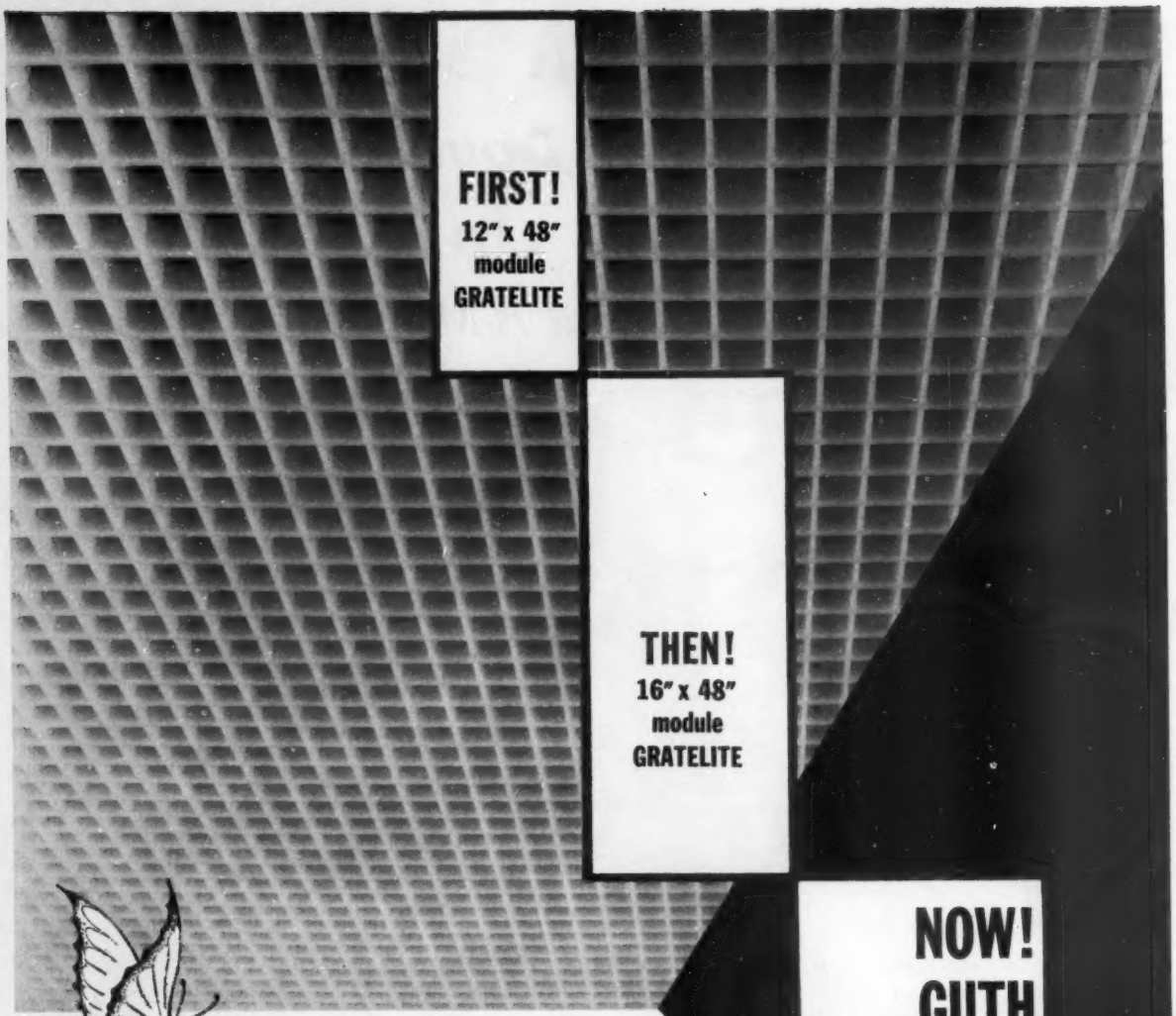

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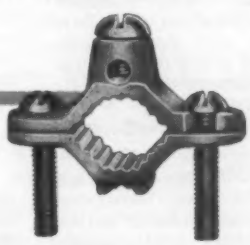

J. A. WEAVER Company

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ORDER FROM YOUR ELECTRICAL WHOLESALER!

CATALOGS and BULLETINS

Available Free to Readers of Electrical South upon Request

HYDRAULIC EQUIPMENT—Truck Equipment Co., 3963 Walnut St., Denver 5, Colo., has made available a catalog containing information on their lines of hydraulic derricks, cable reel carriers, and diggers. It is illustrated and contains data on design features, specifications, and application.

Write in No. A134 on card, pg. 17

CONDUIT AND DUCTS—Orangeburg Mfg. Co., Inc., 375 Park Ave., New York 22, N. Y. has made available informative literature. Catalog No. 52 includes complete details concerning advantages, installation, and properties of Orangeburg fibre conduit, standard conduit—type I, and Nocrete conduit—type II. Catalog 202 offers specifications, installation data, and diagram of the complete Orangeburg Underfloor duct system. Descriptions and catalog numbers of components are also given.

Write in No. A135 on card, pg 17

ELECTRIC HEATING—A 34-page descriptive packet containing color illustrations and complete specifications of eight major types of electric heating units and controls is now available from Arvin Industries, Inc., Electric Heat Div., 13th and Big Four Road, Columbus, Ind. Both radiant and fan-forced heaters are included, in wall, baseboard, and ceiling models.

Write in No. A136 on card, pg 17

WIRING DEVICES — Catalog No. 56, and New Product Bulletins, containing the complete electrical wiring device line of Leviton Mfg. Co., Inc., Brooklyn 22, N. Y. Over 100-pages accurately illustrated and containing electrical and circuit wiring diagrams. Complete cross index for easy reference. Featured are Specification Grade Devices, Interchangeable line, Lev-O-Lock line, and many, many others; devices for every possible use in Industrial, Commercial and Residential applications.

Write in No. A137 on card, pg 17

CARBON PRODUCTS—A 28-page catalog on Motor and Generator Brushes and carbon products telling how to order brushes, grade recommendations, characteristics, and description of brush grades, is available from the Helwig Co., 2536 North 30th St., Milwaukee, Wis.

Write in No. A138 on card, pg 17

LIGHTING FIXTURES—Progress Manufacturing Co., Castor Avenue and Tulip Street, Philadelphia 34, Pa., announces the publication of two new lighting catalogs. "Lighting by Progress," a 52-page booklet, describes their line of residential fixtures. "Home Lighting by Minute Mount" is a 12-page bulletin illustrating new ideas in budget lighting.

Write in No. A139 on card, pg. 17

CABLE, WIRE, AND CORD—Catalog 71A, punched for filing in loose-leaf binder, has been made available by Carol Cable Co., Division of the Crescent Co., Inc., Pawtucket, R. I. Contained in its 24 pages is a complete listing of most of the types of wire and cable offered by the firm.

Write in No. A140 on card, pg. 17

ELECTRICAL EQUIPMENT—The Wadsworth Electric Mfg. Co., Inc., Covington, Ky., has issued a new catalog 58' Guide, containing data on their line of Safety Switches, Service Equipment, Distribution Panels, "E-Z-RED" Circuit Breakers, interchangeable and non-interchangeable, also wiring troughs.

Write in No. A141 on card, pg. 17

POWER BENDER — The lightweight hydraulic power bender #884, manufactured by Greenlee Tool Co., of Rockford, Ill., is described in a new bulletin issued by the company.

Write in No. A142 on card, pg. 17

ELECTRICAL FITTINGS—Concise 36-page catalog illustrates and describes a complete line of electrical fittings, cable racks and wiring specialties. The catalog contains many detail drawings, clear-cut photographic illustrations of mast fittings, cable connectors, traps, hangers and ground clamps in a wide variety of types and sizes. For your free copy, write The M. & W. Electric Mfg. Co., East Palestine, Ohio.

Write in No. A143 on card, pg. 17

WIRING DEVICES — A complete new illustrated catalog and price book is now available from E. M. Wiegmann and Co., Inc., Freeburg, Ill., covering their line of outlet and switch boxes, cut-out and pull boxes, wireholders and racks, and service entrance equipment.

Write in No. A144 on card, pg. 17

COMPRESSION CONNECTORS — New and fully illustrated Bulletin 13 offered by the James R. Kearney Corp., 4236 Clayton Ave., St. Louis 10, Mo., shows their complete line of Squeezon compression fittings. They make all overhead distribution connections from line wire to ground rod on aluminum, ACSR, copper, or combinations of them. Application and installation data are given for tap connectors of several types; service entrance, splicing, jumper and repair sleeves; terminals, stirrups and ground fittings. Mechanical and hydraulic installing tools for both dead and hot line work are listed.

Write in No. A145 on card, pg. 17

WATER HEATING BOILER — Precision Parts Corp., 400 N. First St., Nashville 7, Tenn., has available a bulletin containing catalog information on their electric hot water heating boiler, diagrams of the boiler, and data on the advantages of its use. The boiler comes complete with water circulator and safety valve on models A through K.

Write in No. A146 on card, pg. 17

ADEQUATE WIRING — "Bright Ideas for Ladies" is the title of a new booklet from American Metal Moulding Co., 146 Coit St., Irvington 11, N. J. The booklet was prepared by the Armoured Cable Section of the National Electrical Manufacturers Association to acquaint homemakers with the electrical wiring their homes need for full electrical living now and in the future.

Write in No. A147 on card, pg. 17

ELECTRICAL CONDUITS — "National Electric Conduits" is the 20-page Catalog No. 603 which describes and illustrates the many types of electrical conduits manufactured by National Electric Div., H. K. Porter Co., Porter Bldg., Pittsburgh 22, Pa.

Write in No. A148 on card, pg. 17

TRANSFORMERS—R T & E Corp., 1900 E. North St., Waukesha, Wis., has available a bulletin describing Terra-Tran transformers for residential underground distribution. The 15-page booklet is illustrated and contains complete information on construction, application, and design features.

Write in No. A149 on card, pg. 17

CATALOGS and BULLETINS

ANCHORING DEVICES—An illustrated 32-page catalog, No. 70, describing more than 25 anchoring and drilling devices for making fastenings to masonry, is available from the Arro Expansion Bolt Co., Marion, Ohio.

Write in No. A150 on card, pg. 17

CONNECTORS — Comprehensive, up-to-date information on electrical connections for overhead lines in transmission and distribution is now available in one convenient publication, a 10-page manual issued by Burndy Corp., Norwalk, Conn., on connection techniques, connectors, and installation tooling.

Write in No. A151 on card, pg. 17

ELECTRIC HEATING — Electromode Division of Commercial Controls Corp., 570 Culver Rd., Rochester 3, N. Y., is now offering their complete line of electric heaters and heating systems for the home. Descriptions, specifications and illustrations are included for wall and portable heaters for large and small rooms, radiant panel heaters, baseboard heaters and radiant cable heat.

Write in No. A152 on card, pg. 17

ELECTRICAL EQUIPMENT — A new 12-page pictorial bulletin briefly describes manufacturing facilities and electrical products of Crouse-Hinds Co., Syracuse 1, N. Y. Emphasis is on the variety of equipment available in the four product lines: Condulet electrical equipment, floodlights, aviation lighting equipment, and traffic control.

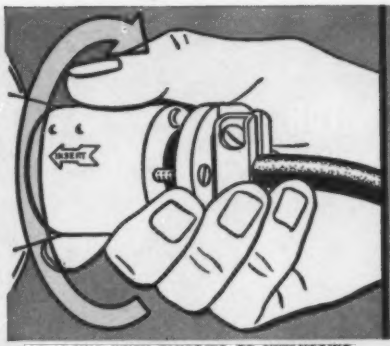
Write in No. A153 on card, pg. 17

CONNECTOR BULLETINS — Six new bulletins have been released by Ilsco Corp., 4730 Madison Rd., Cincinnati, Ohio. They cover the Ilsco line of solderless connectors, special connectors, lugs, neutral bars, crimp lugs, and the Ilsco Lok-A-Blok. The bulletins include descriptive material, dimensions, and packaging data.

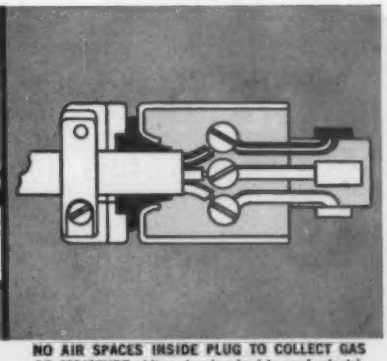
Write in No. A154 on card, pg. 17

WIRE PULLING LUBRICANT — Illustrated six-page folder showing the advantages of an improved Y-Er Eas wire pulling lubricant is available from Electro Compound Co., 4145 W. 150th St., Cleveland 11, Ohio.

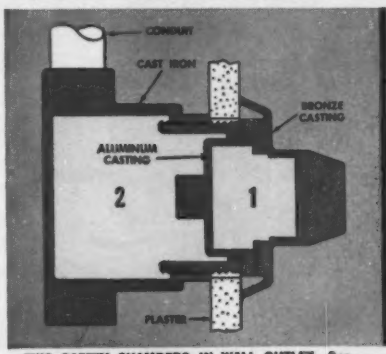
Write in No. A155 on card, pg. 17



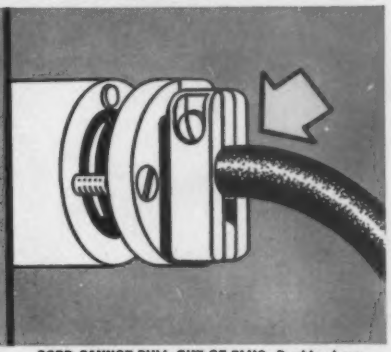
NO ARCING WHEN PLUGGING OR UNPLUGGING. Outlet is electrically "dead" until plug is inserted and rotated 22-25°. Reverse turn disconnects current before plug is removed. Spring pressure and keyed construction prevent accidental disconnection.



NO AIR SPACES INSIDE PLUG TO COLLECT GAS OR MOISTURE. After plug is wired to cord, electrician pours a self-hardening insulating resin into all air spaces. Interior of plug becomes solid, water-tight, vapor-tight mass.



TWO SAFETY CHAMBERS IN WALL OUTLET. Gas-tight chamber No. 1 (bronze and aluminum castings) contains and seals off switching mechanism. Cast iron chamber No. 2 keeps minor internal explosions from spreading to room.



CORD CANNOT PULL OUT OF PLUG. Double-clamping cord-grip relieves strain on plug terminals. And because terminals and wires are completely embedded in insulating resin, connections cannot loosen to cause arcing.

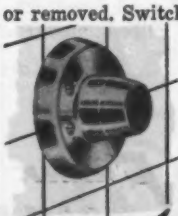
NEW

EXPLOSION-PROOF RECEPTACLE AND PLUG

FOR CLASS I, GROUP C OR D, ATMOSPHERES

The Hubbellock Explosion-Proof Receptacle and Plug prevent arcing when electrical connections are made or broken in explosive atmospheres. No special wiring is required for installation in new or existing structures.

There are no air spaces in the plug where explosive gases can collect. No current can flow to the receptacle contacts while the plug is being inserted or removed. Switching takes place inside a vapor-sealed safety chamber of heavy bronze and aluminum castings.



Any 20-ampere, 125-volt, 60 cycle A.C. appliance may be operated from the receptacle by substituting the Hubbellock Explosion-Proof plug for the present plug. Appliances equipped with the Explosion-Proof plug will also operate in conventional 3-wire Hubbellock receptacles.

Plug and receptacle are listed by Underwriters' Laboratories and are described by the National Fire Protection Association for use in Class I, Group C or D, explosive atmospheres. They are ideal for hazardous industrial areas and for hospital operating and delivery rooms.

Write now for detailed specifications and prices.

"Hubbellock" is a registered trademark of Harvey Hubbell, Inc.

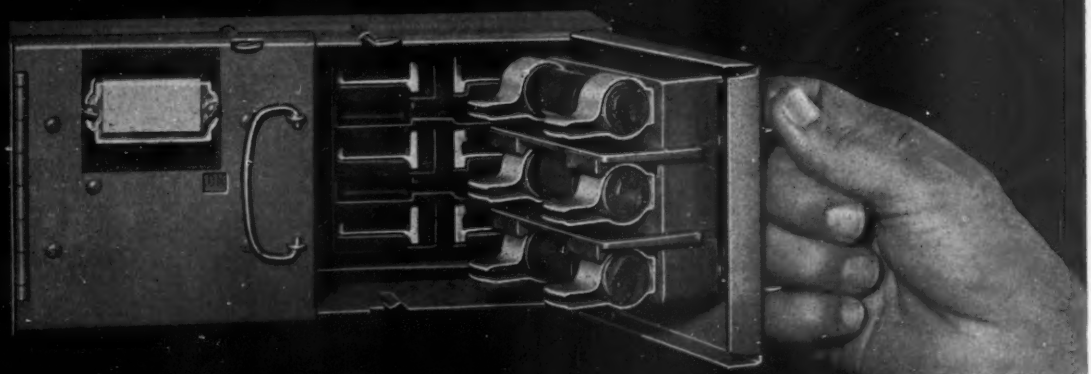
EXPLOSION PROOF Hubbellock® WIRING DEVICES

HARVEY HUBBELL, INCORPORATED • BRIDGEPORT 2, CONNECTICUT In Canada: Scarborough, Ontario

NEW! TWIN UNITS FOR 19" WIDE BOXES

FRANK ADAM...

HINGED COVER SWITCHES



ONE-PIECE STEEL ENCLOSURES

Furnished with doors as standard.
Flush or surface mounting.
Available in 4¾" or 6" depths.
Extra wide wiring gutters.
Silver-plated connections throughout.
100 to 400 amp. mains.

TYPE KSF-KLAMPSWITCHFUZ

(Clamp-Switch-Fuse)

Now—twin hinged-cover 30/30 or 60/60 amp. switches for 19" wide enclosures! Formerly available only in 24" and 33" wide boxes, the new smaller size saves both space and money.

Now—only 4½" high instead of former 6" height. Permits almost 25% increase in number of circuits in any box, or reduces the size of enclosure needed.

KSF Switches are ideal for installation where the more expensive handle-operated quick-make, quick-break switches are not required.

KSF Switches have increased horsepower rating—are furnished for plug-in or bolt-on connections for quick, easy circuit changes. All contacts are heavily silver-plated. Padlock device on all switches.

Your ⓕ distributor has them in stock

See our catalog in SWEET'S

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safety switches • load centers • Quikheter

CATALOGS and BULLETINS

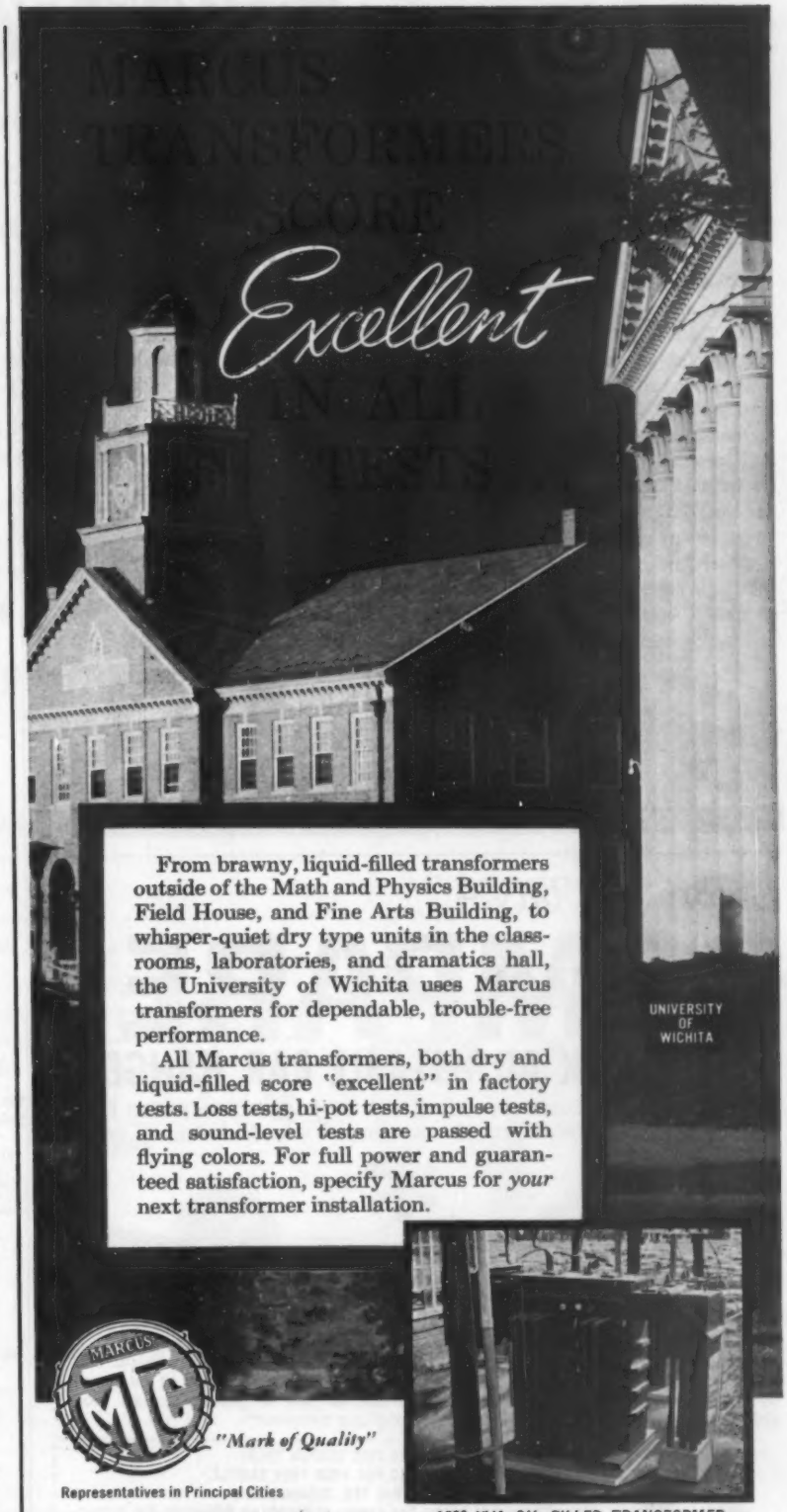
FLUORESCENT FIXTURES—The new Miller Sabre fluorescent fixture is illustrated in the Sabre catalog, page 13, published by The Miller Company, Meriden, Conn. This page points out application, construction details, and dimensional, illumination, and installation data.
Write in No. A156 on card, pg. 17

TROFFER CATALOG—A 36-page catalog, with complete information on their newly re-designed architectural troffers has been released by Smithcraft Lighting Division, Chelsea, Mass. Divided into sections for selection of lighting units, the catalog gives complete illustrations and data for 1 and 2 foot troffers in all types of ceiling construction. Also included in the catalog is information on ceiling lighting patterns, shielding designs, lighting techniques and applications.
Write in No. A157 on card, pg. 17

CONSTRUCTION ANCHORS — "Anchoring for Power and Communication Lines," a completely illustrated manual on improving line construction with better anchoring, has been published by the Advertising Dept., the A. B. Chance Co., Centralia, Mo. The 25-page booklet shows how to install the right anchor at the right place in the right way.
Write in No. A158 on card, pg. 17

SMALL WIRE STRAPS—Added to the one-hole Viking strap line are three new Midget straps for small wires. The #616 for fastening RX and UF 2/14, 2/12, and BX 2/14; the #416 for wires to 1/4" OD; and #316 for wires of 3/16" and 1/4". These galvanized straps, designed to take several sizes of wires, are featured in literature released by W. W. Cross & Co., Viking Cable and Fastening Devices, Greenville, R. I.
Write in No. A159 on card, pg. 17

RESIDENTIAL LIGHTING — A new catalog featuring their line of residential lighting fixtures has recently been issued by John C. Virden Co., 6103 Longfellow Ave., Cleveland 3, Ohio. The 48-page booklet is illustrated and in color. It pictures and describes incandescent and fluorescent fixtures for every room in the house and every design motif.
Write in No. A160 on card, pg. 17



From brawny, liquid-filled transformers outside of the Math and Physics Building, Field House, and Fine Arts Building, to whisper-quiet dry type units in the classrooms, laboratories, and dramatics hall, the University of Wichita uses Marcus transformers for dependable, trouble-free performance.

All Marcus transformers, both dry and liquid-filled score "excellent" in factory tests. Loss tests, hi-pot tests, impulse tests, and sound-level tests are passed with flying colors. For full power and guaranteed satisfaction, specify Marcus for *your* next transformer installation.

1500 KVA OIL FILLED TRANSFORMER

MARCUS MTC "Mark of Quality"

Representatives in Principal Cities

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RAHWAY, NEW JERSEY

A COMPLETE LINE OF DRY TYPE AND LIQUID-FILLED TRANSFORMERS THRU 5000 KVA

REVOLUTIONARY NEWS!
IT'S SILVER LIGHTING—
IT'S TEL...
BY STA-BRITE!

DESIGNERS
ENGINEERS
MANUFACTURERS

THE ULTIMATE IN LIGHTING FIXTURES

Whatever your requirements in lighting homes, offices and factories —depend on STA-BRITE'S quality fixtures and experienced engineering staff.

Write on your company letterhead for Sta-Brite's 1961 Price List.

Put Sta-Brite's newest fluorescent fixture at the top of your list — ask for TEL...The Exquisite Luminaire. It has already been adopted as standard lighting by one of our large public utilities! A completely new innovation, developed after months of research, TEL was designed to answer the need for deluxe appearance, low cost, and unlimited flexibility. Most important, perhaps, is the beautiful silver light it affords, and the fact that it produces more foot candles than similar fixtures, at less cost! TEL is unusually shallow; hugs close to the ceiling; has the appearance of a wraparound; and contains 4 tubes in just 14¾" of space! It may be used with many different types of shielding. The TEL is just one more reason why STA-BRITE is your answer for all types of lighting. CALL ON US SOON.

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FLUORESCENT MANUFACTURING COMPANY

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Before you buy –

COMPARE*

BLACKHAWK ADJUSTABLE BAR HANGER

Send for your free sample – find out for yourself why it is the fastest, easiest, neatest, most economical way to hang all ceiling light fixtures.

Check Blackhawk's exclusive "clipper" – no screws to tighten – saves you time and money.

Available with or without fixture stud. Used between joists from 12" to 18"–18" to 26" Blackhawk Adjustable Bar Hangers are made of heavy gauge steel. Adjustable to required spacing. Support edges of hanger formed to act as plaster gauge. No notching necessary.

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Please send me my free sample of Blackhawk Adjustable Bar Hanger

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Blackhawk Industries, Dubuque, Iowa
Where the new ideas come from

CATALOGS and BULLETINS

MODULAR LIGHTING—A twelve-page folder describing and illustrating their line of surfaced and recessed fluorescent modular fixtures is announced by Moe Light of Thomas Industries, Inc., Lighting Division, Brook & Broadway, Louisville, Ky. Complete coefficient of utilization and candlepower distribution tables are included for each set of fixtures.
Write in No. A161 on card, pg. 17

BUILT-IN HEATERS—Thermador Electrical Manufacturing Co., 5119 District Blvd., Los Angeles 22, Calif., has announced the availability of three new catalog sheets on their line of built-in electric heaters. The heaters described are their portable radiant-fan heater, electric ceiling heater, and baseboard electric heater.
Write in No. A162 on card, pg. 17

CABLE SUPPORTING TRAYS — The Globe Co., 4000 South Princeton Ave., Chicago 9, Ill., has made available a new catalog on their line of cable supporting tray systems and accessories. The catalog contains information on design features, specifications, and installation.
Write in No. A163 on card, pg. 17

CONDUIT—With Rigid Polyvinyl Chloride Electrical Conduit gaining increasing popularity in the electrical field, Kraloy Plastic Pipe Co., Inc. offers a new, complete 20-page catalog. Included are comprehensive test results, specifications information, installation instruction, corrosion resistant charts, and other valuable data. Write Kraloy Plastic Pipe Co., Inc., Electrical Conduit Division, 402 West Central Avenue, Santa Ana, California.
Write in No. A164 on card, pg. 17

SWITCH & OUTLET BOXES AND ELECTRICAL FITTINGS —Catalogs B-960 and F-960 respectively feature the latest in switch and outlet boxes and electrical fittings. Completely illustrated, they contain over 100 pages of technical and informational data. A unique set of indexes in the fittings catalog make it the easiest reference catalog in its field. Available from the Electrical Fittings Corp., 37-50 57th St., Woodside 77, New York.
Write in No. A165 on card, pg. 17

INFORMATION CENTER

Help yourself to free literature and more details on any products mentioned in this issue.

Instead of writing a dozen different manufacturers for free literature and more information on products, equipment, or services, just insert on the cards below the appropriate key numbers of the items in which you are interested. These cards may be used to get information on products mentioned in the following departments (see Contents Page for page number):

Catalogs and Bulletins
New Utility Equipment
New Electrical Products
Advertisements

Be sure to print or write legibly your name and address—drop it in the nearest mail box and

ES pays the postage!

FEBRUARY, 1961

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These cards can help you get valuable information

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BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 582, SEC. 34.9, P. L. & R., ATLANTA, GA.

Electrical South
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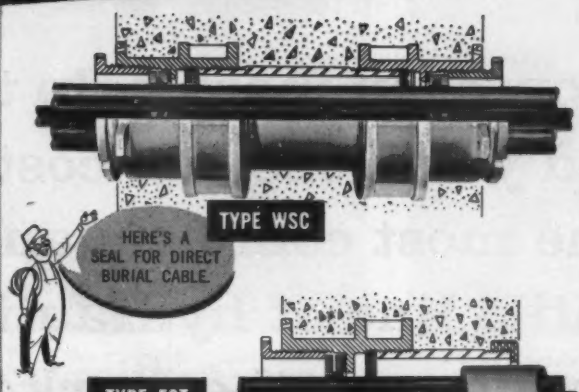
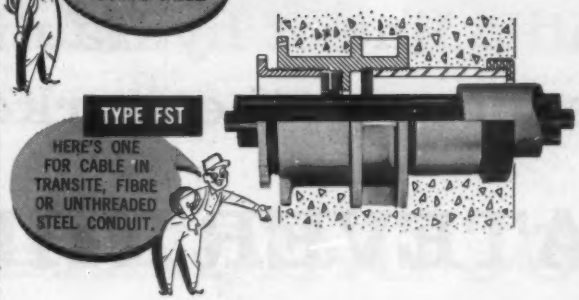
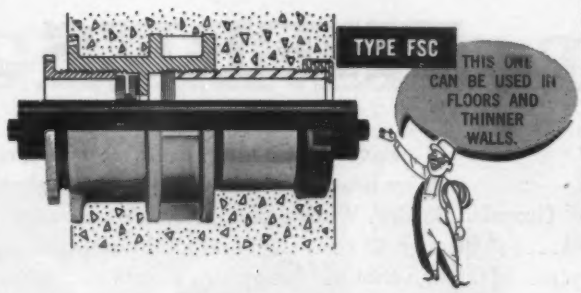
ATLANTA 8, GEORGIA

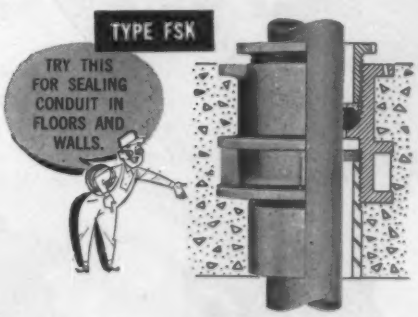
NEW! a complete line of O.Z. WATERTIGHT ENTRANCE FITTINGS for Conduit or Cable







End leakage problems once and for all! O.Z.'s new wall and floor entrance fittings for installation in concrete provide a positively watertight seal around conduit or cable at any pass-through point! Use them with threaded or unthreaded steel conduit, fibre or Transite® conduit, or exposed cables of varying number and sizes. Gland-type sealing assemblies, with pressure bushings, may be tightened at any time. Fittings accommodate conduit ranging from ¾" to 6". Standard types, sizes available from stock. Specials made to order.



For more information on fittings and other O.Z. products, call your local distributor, or write to the company.

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262 BOND STREET • BROOKLYN 17, N. Y.

- CAST IRON BOXES
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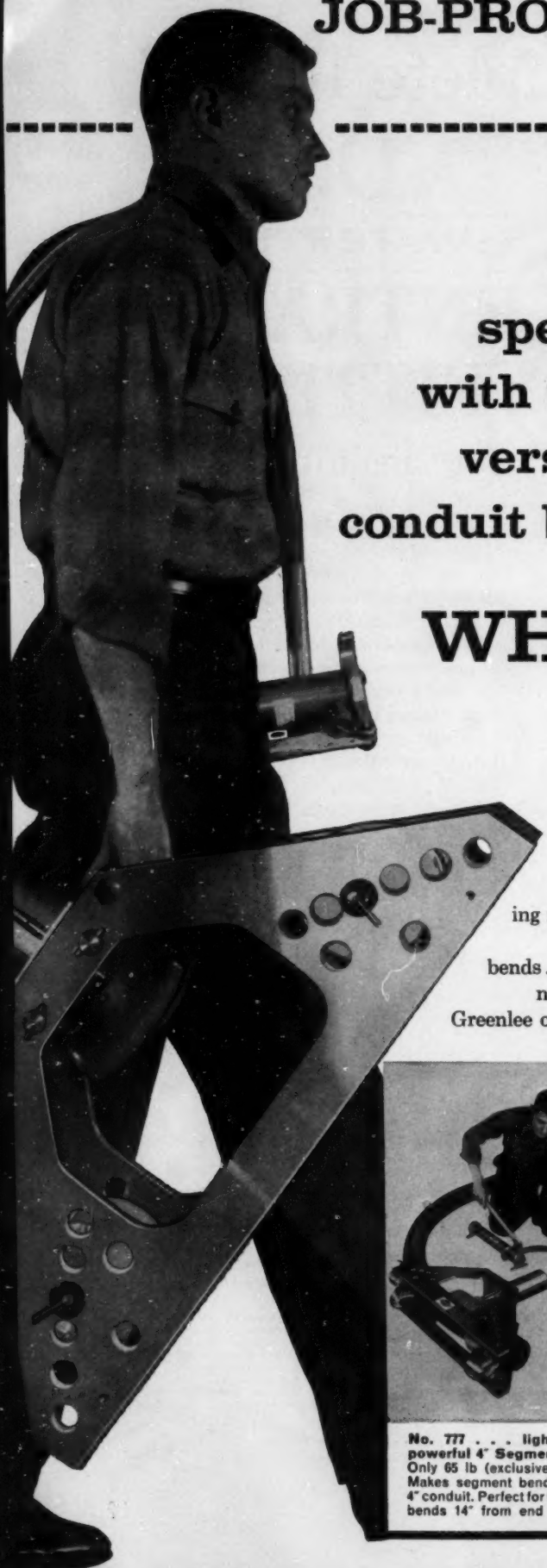
JOB-PROFIT TOOLING IDEAS

FROM GREENLEE



now even more help to speed your jobs, cut costs with the most complete and versatile line of hydraulic conduit benders on the market

WHATEVER THE ...THERE'S A

Save valuable time and materials, *control costs* by bending conduit right on the job with a Greenlee Bender. Wide choice of models for every bending need... ½" through 6" sizes steel and aluminum conduit and pipe. Make one-shot 90° bends . . . offsets . . . concentric bends... large sweeps... thin-wall bends. With the addition of the new No. 777 segment bender (left) for 1¼" thru 4" conduit, Greenlee offers you the widest selection by far, *all from a single source!*

No. 777 . . . lightest, most powerful 4" Segment Bender. Only 65 lb (exclusive of shoes) Makes segment bends 1¼" thru 4" conduit. Perfect for tight kicks—bends 14" from end of 4" pipe.

One-shot 90° bending with Greenlee No. 777 Bender. An *exclusive* advantage. Adapts to one-shot 90° bending of ½" thru 2" conduit simply with addition of a few optional parts.

Thin-wall bending with Greenlee No. 777 bender. An *exclusive* advantage. With quickly mounted attachment the No. 777 bender is economically converted to bend thin-wall conduit ¾" thru 2".

For ½" thru 4" Conduit . . . Greenlee No. 884 bender makes fast 90° bends in one shot . . . steel and aluminum conduit. Lightweight, one-man operated with hand or power pump.

Offsets in seconds with Greenlee No. 888 Multipurpose Bender . . . A fast, extra-versatile bender for quickly making offsets in ½" thru 2" conduit . . . with one setting, one shot. Offsets always in perfect alignment—no doglegs! Also makes 90° bends, close to the end of conduit. Fast operation with hand or power pump.

BENDING JOB GREENLEE TO DO IT!

For ½" thru 3" conduit . . . Greenlee No. 883 bender makes up to 90° bends with one shot in steel and aluminum conduit. Lightweight, portable. One-man operated with hand or power pump. Attachments available for thin-wall bending.

For ½" thru 2" conduit . . . Greenlee No. 880-M2 lightweight bender makes up to 90° bends with one shot in steel and aluminum conduit. Fast one-man operation with hand or power pump. Attachments available for thin-wall bending.

For 1¼" thru 6" conduit . . . Greenlee No. 785-BE power bender is equipped with 90° bending shoes for fast, easy operation. Can be used for one-shot or segment bending. Regularly equipped to bend sizes to 5", with 6" attachment optional.

GREENLEE TOOL CO., 1953 Columbia Avenue, Rockford, Illinois

Ask your distributor for a demonstration, or write for literature.

TOOLS FOR CRAFTSMEN

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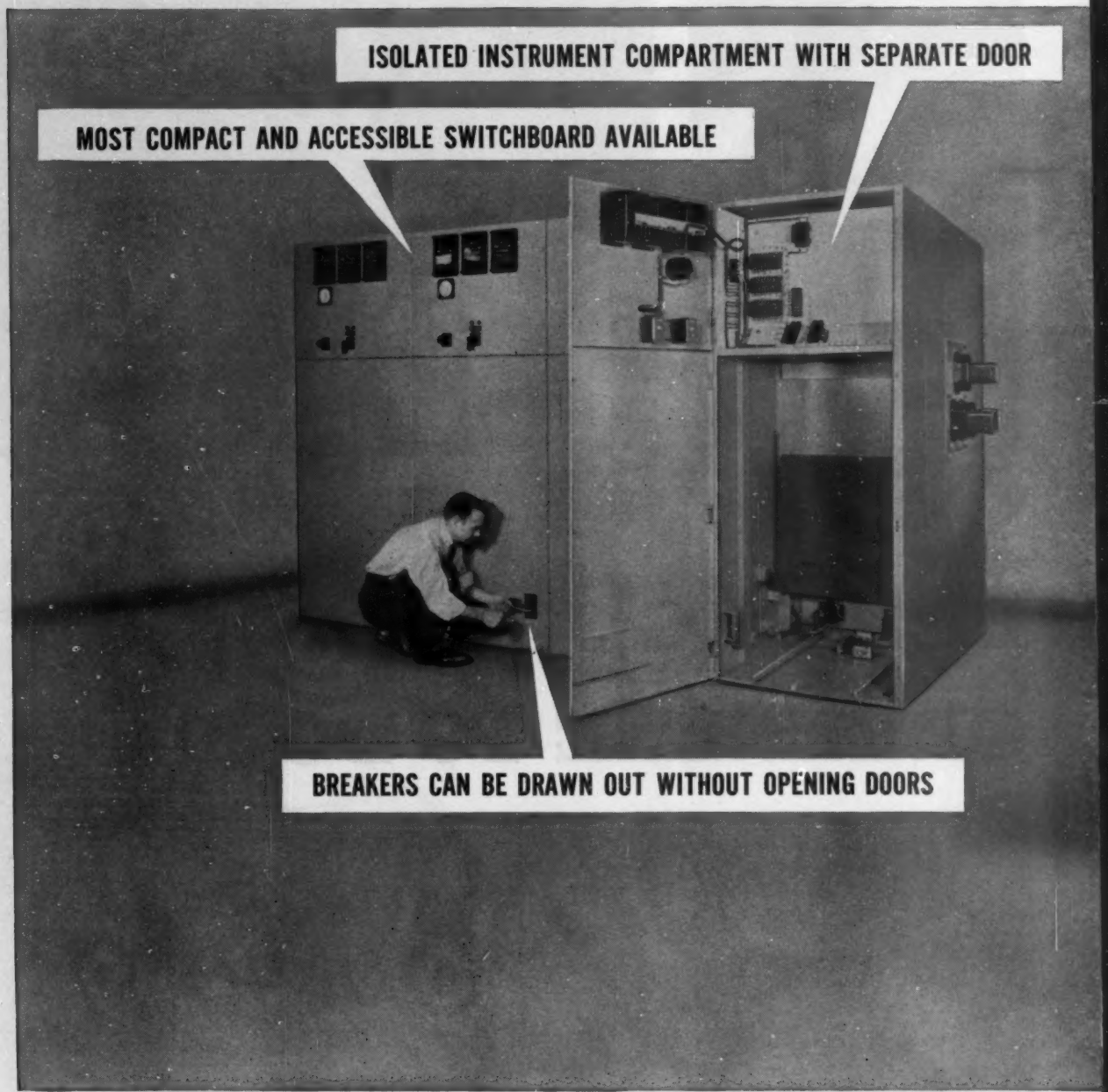
JOB PROFIT TOOLING

. . . cost control for contractors


ISOLATED INSTRUMENT COMPARTMENT WITH SEPARATE DOOR
MOST COMPACT AND ACCESSIBLE SWITCHBOARD AVAILABLE
BREAKERS CAN BE DRAWN OUT WITHOUT OPENING DOORS

NOW YOU CAN ALWAYS,

have fast, safe operation of your

Stored energy closing is just one of the many big progressive steps forward you will find in this all-new I-T-E 13.8 kv switchgear. So is the separate, isolated instrument compartment . . . and the closed door drawout . . . and the more compact switchboard! Here is new safety, new long life potential, and new greater assurance of uninterrupted service.

One man can handle the entire maintenance job. The breaker is not only smaller, it's significantly lighter—the result of using new, more modern materials. Phase barriers may be easily removed by one man. Arc chutes can be tilted back. The breaker frame may even be flipped over without assistance. With the huge cable makeup area and the easily accessible bus, this is truly the easiest to maintain 13.8 kv switchgear yet.

ALWAYS, IN ALL WAYS

13.8 kv circuit breakers every time

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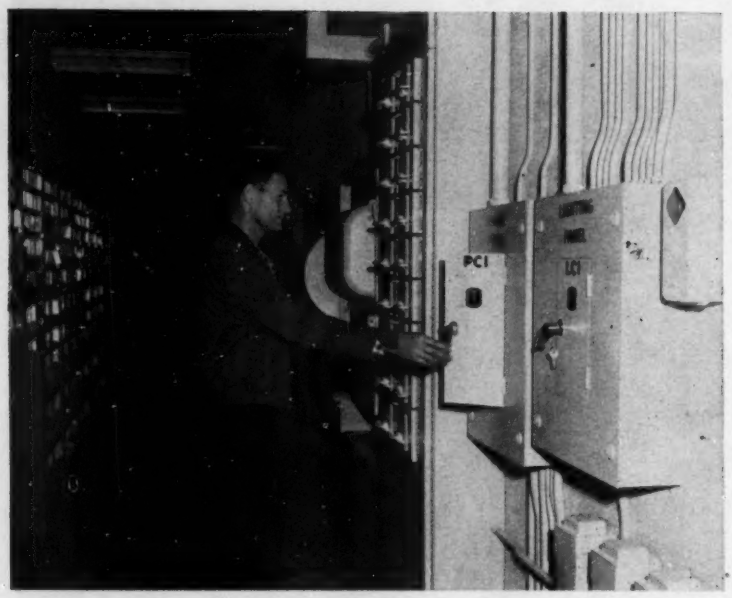
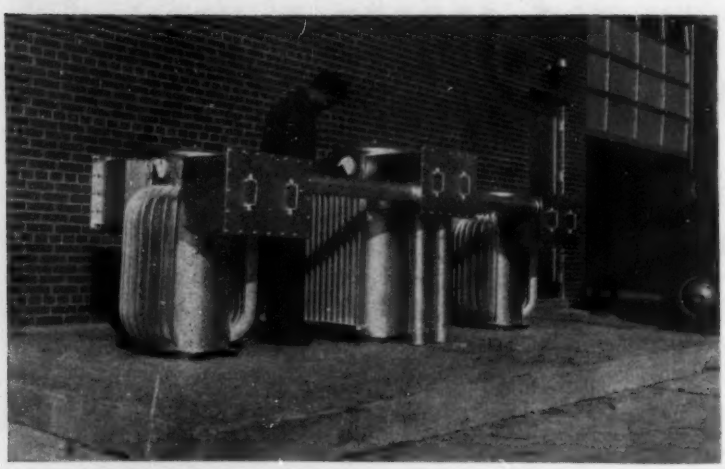
I-T-E CIRCUIT BREAKER COMPANY

Utility substation work demands

More stringent installation requirements mean less competition but qualified contractors must make investment in special tools



Contractor Davis is inspecting the distribution center supplying heat and lighting in the TVA service center power stores building. This is typical of the distribution centers of the other three buildings.



Two 100-kva and one 167½-kva transformers, outside the TVA garage, are on a concrete platform and have special junction boxes which enclose primary and secondary terminals for concrete pad installation.

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electrical Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors
- Industrial Engineers
- Consulting Engineers ✓

By Glyn L. Davis, Davis-Longsworth Electric Corp., Knoxville, Tenn.

◆ With more and more industries taking their power from the utility companies at primary voltage, electrical contractors are finding a valuable source of profitable business in the design and installation of the industry-owned substations necessitated by the primary metering arrangement.

At the same time, the primary metering and industry-owned substation arrangement gives an industry more flexibility in serving a large area, especially if facilities are separated in various buildings.

The contractor doing this work for an industrial customer is confronted with a job requiring better qualified personnel and an investment in better tools and equipment in order to handle the primary voltage safely.

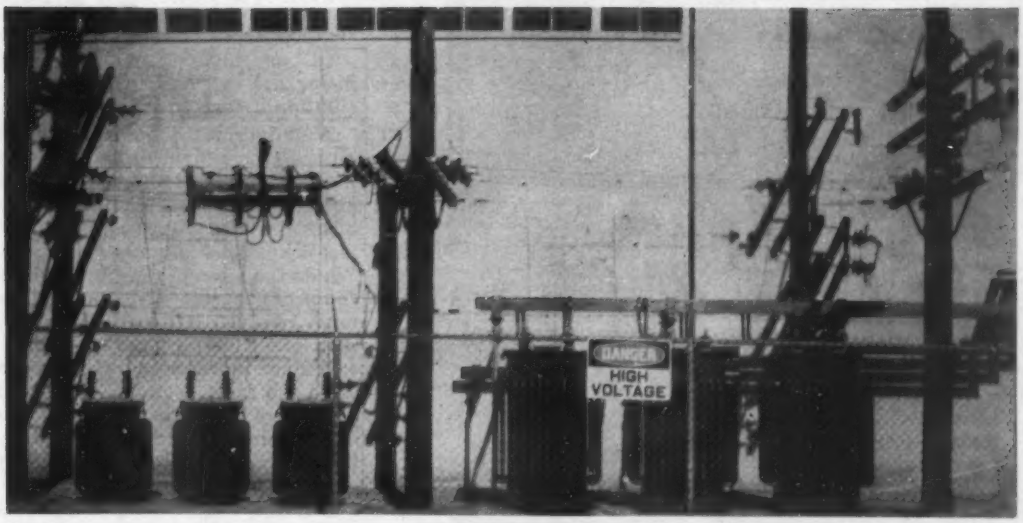
Thus it eliminates a lot of undesirable competition.

At Morristown, Tenn., we are completing such a job at the Morristown Molding Company plant. The substation bus feeders and entrance were subcontracted from the Morristown Power Board.

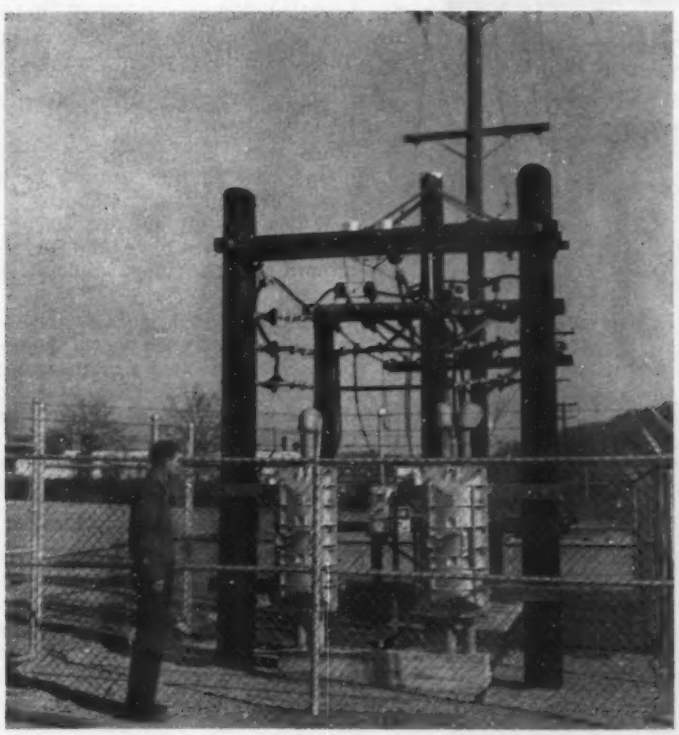
We had a contract for the electrical work in the factory, including setting and connecting electrical motors and machinery. The job included one 300-hp, 4,160-volt motor and one 150-hp, 4,160-volt motor, fed from a separate substation for these motors. The main plant voltage was 220, three-phase.

We had three contracts on that

better planning and equipment



This shows the bank of transformers put up by Davis-Longstreet for the Morristown Molding Company.



The outdoor distribution center and transformer station are fed from overhead from the utility's 13,800-volt primary. This substation feeds a group of four buildings through cast iron breakers.

Davis-Longsworth put up the pole on the left, near the Knoxville Utility Board pole at the right, at the TVA service center.

L. K. Smith, right, resident engineer and project manager for the TVA, looks over plans with Glyn L. Davis of Davis-Longsworth Electric Corp.

All the switches at the distribution center are marked to show what they feed and from where they are feeding at the TVA service center.

job: one with the City of Morristown, which erected the plant; one with the industrial company; and one with the utility system.

Having proper tools and equipment to handle primary voltage led to the additional contracts. In handling primary equipment, an electrical contractor has to be careful with the wires so as not to damage insulation. The job also requires special test equipment, such as highpot machine and motorized meggers for testing insulation before energizing.

We silverplated bus connections on the Morristown project. That is not always required on jobs, but it keeps down corrosion between buses where exposed to the weather and adverse conditions. We do the silverplating in our own shop. Since we have the equipment, we use it on all our work. It insures a better job.

We are more or less responsible for a job for a period of time, and by silverplating the chances of bus heating between connections are lessened. If connections are not good, they would corrode.

Ten years ago power companies were doing most of this type work. Now they are subcontracting much of it.

We have long maintained and installed lighting for ball fields and playgrounds. As we worked into larger jobs, we increased our equipment.

The industrial plant substation type of work has increased because there are more industrial plants now in our section, as is true over the industrial South.

Weather conditions are the biggest problem we have, and underground work is more difficult in winter.

We have a ditch machine for doing our own trench work. Sometimes after we start a ditch, water gets into it and we have to pump it out, with pump equipment we usually rent.

At Oak Ridge, where we have done a lot of work in the areas of the Union Carbide Nuclear Company-operated plants, we have installed pole-mounted substations and platform stations—fenced in, of course.

The last few years our work has required more line trucks, hot line tools, and equipment, as well as the test equipment necessary to check circuits before energizing.

Industrial substation jobs require a better class of electricians, too, than does normal construction.

(Continued on page 114)

Wiring an automobile storage area

. . . is governed by stringent Code regulations which receive too little attention

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electrical Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors ✓
- Industrial Engineers ✓
- Consulting Engineers ✓

By M. D. Leslie, Chief Electrical Inspector, Retired, Kansas City, Mo.

◆ If you are a contractor and bid on a job of wiring for a building, you should be concerned about the wiring in any place planned for the storage of automobiles.

It is quite common today to include in any business or apartment building space for the storage of automobiles. In the general specifications, the architect will state that all wiring is to be done in accordance with the rules and regulations of the National Board of Fire Underwriters, but seldom anything is said about the type of wiring to be installed in the area for the storage of automobiles.

Nobody has paid much attention to this although the National Electrical Code has very stringent regulations with regard to such installations.

Highly involved situation

Wiring in a garage as classified in the National Electrical Code should be Class 1 Division 2. Now here we get into a highly involved situation. Any wiring installed in such storage places below ground level or above ground level must comply. Of course, there are the recent changes in the Code that dwell on the substitution of air pressure to overcome the hazards of the explosive gases. But the architect seems to prefer exhaust fans which may or may not do the job.

The point is that regardless of whether the change of air is created by exhaust or pressure, who knows how much air is required? There remains the fact that the operator may not turn them on, to save electrical bills.

Now it evolves upon the contractor and the inspector to see whether or not the terms of the Code are being complied with. Otherwise, the contractor may find himself confronted with the complete replacement of the wiring. Standard conduit wiring with standard outlet boxes installed in a concrete slab will not comply with the requirements of Class 1, Division 1, and there is no way in which such wiring can be converted to meet the requirements of the Code.

Therefore, if the inspector is strict and there are no compensating circumstances, he is faced with the responsibility of completely replacing the conduit wiring.

'How come now?'

Now you may say that this has been going on for years and no one has ever said anything about it, and "how come now?" It all goes back to the early days of the automobile, when the cars were stored out of doors, on the street, or in private garages. About 40 years ago, people began to think it would be a good idea to keep the automobile in the house where it would be easy to start, which was an important item in those days, and more comfortable for riding.

People began to like the idea of an enclosed car that would be warm inside—heaters were unknown—and they could go to work in comfort. There was no reason that anyone could see why the car should not be stored in the basement. Now this went on and developed into the basement storage of cars in public buildings. There was nothing in the National Electrical Code to prevent it and the subject was never a part of the Code until the 1930's.

Very few architects, engineers, electricians, or inspectors considered anything but the owner's desire to fix a good place to park his car. In recent years this has gotten into an entirely different situation. It is not the matter of parking just a car or two in a residence, because we now have completely underground storage for hundreds of cars.

In fact, most high apartment buildings have moved the boiler room and the air-conditioning equipment to the roof and have given what used to be the basement, and perhaps several floors above, for parking tenants' cars.

Look at specifications

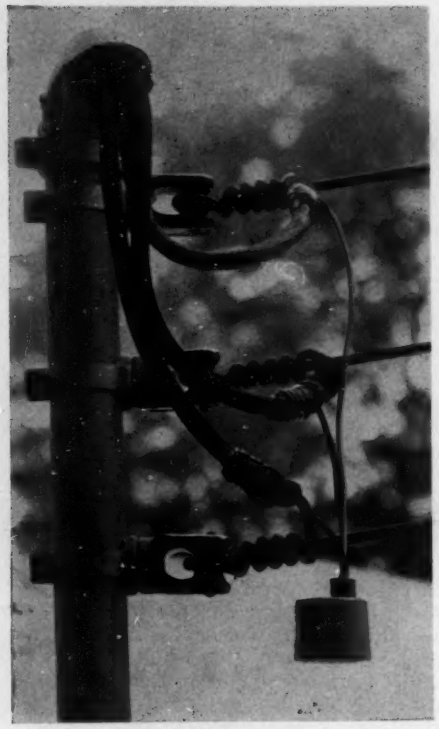
Now you as a contractor had better take a look at the specifications. You cannot make an ordinary outlet box embedded in concrete conform to the specifications for a box in Class 1, Division 1. Maybe the specification on the plans fails to show this, but it will be your responsibility.

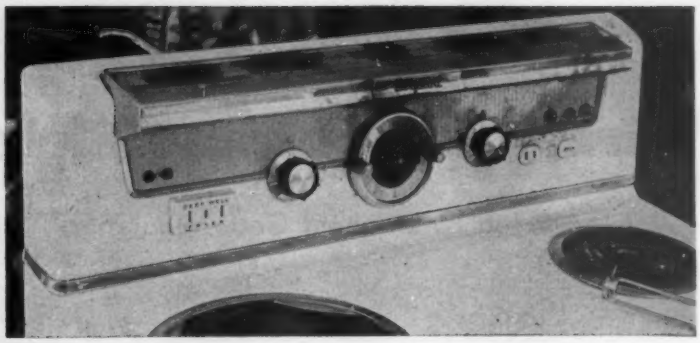
Suppose we take a look at this situation and see how we have arrived at the place we are now. For years cars were stored in what are now considered hazardous areas. There were no Code restrictions and nothing happened. So no one paid any attention to them and the condition grew and grew.

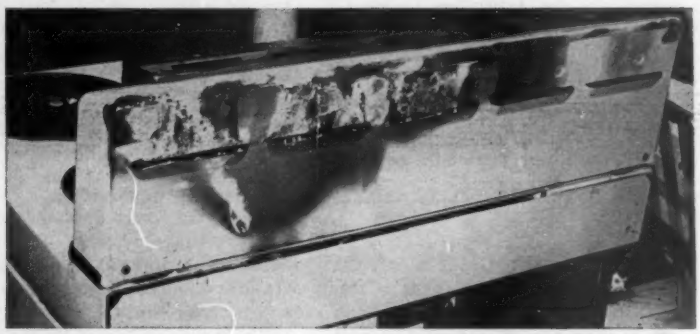
There are many places constructed (20) or (30) years ago with storage for many cars. Inspectors passed on this with no word from the Code, and they failed to note any violation in spite of new Code rulings. Nobody had any trouble.

But now when the contractor or inspector points out infractions to the violators of the present Code, the people who own and build buildings point out other buildings of similar character which have been operating for years without trouble and they ask why do we now impose such stringent regulations.

(Continued on page 113)







An easily installed arrester . . . can prevent the damage resulting from lightning-induced overvoltage.

Need exists for lightning protection

The contractor can easily provide a service for his customer by installing a properly engineered lightning arrester system

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electrical Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors ✓
- Industrial Engineers
- Consulting Engineers

By Fred W. Goette, III, Stewart-Goette Electric Co., Macon, Ga.

◆ Since the electrical contracting business is basically a service industry, it is important that every possibility for rendering better customer service be thoroughly investigated. One largely overlooked service that the contractor can easily provide for his customer is lightning protection, through the installation of a properly engineered arrester system.

There is a large market, and a very real need, for lightning protection of the modern residence. In particular, there is need for protection from lightning-induced voltage surges entering homes via the service entrance conductors and wreaking havoc with a variety of expensive electric appliances.

Lightning usually enters a structure on one of three paths. First, the structure may sustain a direct hit by a lightning stroke. This is a comparatively rare occurrence and usually results in non-electrical damage.

Another possible path is that furnished by a television antenna and its lead-in cable. These outdoor antennas furnish an excellent target for lightning strokes, but the house is usually protected by a fairly effective gap-type arrester.

Finally, high voltage surges caused by lightning may enter the electric system by way of the service entrance conductors. This is a far more common occurrence than is generally acknowledged and is often the cause of mysterious appliance failure.

It is in this last possibility that the electrical contractor enters the picture. Through the installation of appropriate lightning arresters, he can, almost without exception, protect the home against damage from this source. The high voltage surges are transferred to the service conductors in two ways. A direct stroke may hit the aerial power lines in the vicinity, placing a tremendous charge on the con-

ductors. The overvoltage then travels along the wires in both directions from the hit. Overvoltage caused by a direct hit may reach several million volts. High overvoltages may also be caused by what is called an induced stroke.

Cause of lightning

To understand the induced stroke, we must first consider the basic cause of lightning itself. In the thundercloud, positive and negative electrical charges become separated; the negative charges gathering in the lower portion of the cloud, the positive charges in the upper portion. These charges follow the law of the attraction of opposites. Acting like a huge capacitor, they cause a heavy concentration of positive charges in the earth's surface and also in the aerial power lines in the affected area.

The large excess positive charge on the power lines is bound in one location until the attracting charges in the cloud are dissipated by a lightning stroke. When this occurs the excess charge on the lines is free to move and, seeking to unite with negative charges, travels along the conductor in a wave. This wave may reach a peak of 500,000 volts and the discharge current can exceed 1,500 amperes.

One can well imagine the result when electric appliances are subjected to overvoltages of this magnitude. It is the job of the lightning arrester to remove this high voltage wave from the line before it enters a building and destroys appliances or causes fire.

New, low cost arresters

Due to a great deal of recent research in this field, the efficiency of the lightning arrester has been improved, and new, low cost models designed for residential service have been introduced. These arresters are usually of the encapsulated pellet type. They consist of a tube containing a column of small pellets of lead peroxide which are coated with an insulating film. In series with the path formed by these pellets, there is usually sealed dry air gap designed to spark over at a constant voltage value.

The lightning arrester must perform two principal functions. First it must remove the high voltage travelling wave and conduct it harmlessly to ground. Having conducted the high voltage wave to ground, it must then interrupt the

(Continued on page 113)

Contractors need help

And it can best come from the electrical supplier

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electric Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors
- Industrial Engineers
- Consulting Engineers

By Ross Cutting, Electrical Contractor, Orlando, Fla.

◆ The small contractor — and there are thousands of us— is in need of help, and it seems that the help he needs can come best from his electrical supplier, a person who benefits from this man's activities.

The small contractor has to be advertising manager, ad-copy-writer, business solicitor, employment manager, treasurer, order clerk, stock clerk, gang foreman, timekeeper, estimator, paymaster, collector, bookkeeper, auditor, husband, and father—and his wife has to answer the phone!

Even with considerable competition he can get along pretty well if things go right but it doesn't take many things going wrong to cause his profits to evaporate before his eyes.

The small contractor hasn't much time to keep close watch on the efficiency of his operations yet he is the very type of operator who needs to be most efficient—that's why he should have help.

Is the order ready?

When he comes in to the supplier's city counter at 8:00 a.m. to pick up an order phoned in yesterday, is it ready for him, or does he have to wait 20 minutes for the order to be completed because of a rush at closing time yesterday? With his three men waiting he loses an hour of labor—$3.00.

Then does he get out on the job, 12 miles away, and find the supplier's clerk gave him 12-2 instead of 12-2 WG or made some other mistake in the order that requires a 24-mile round trip and an hour's time? $6.40 lost!

Then every so often he completes a trim-out and finds that this new building contractor is running low on funds and he cannot collect his bill—maybe for months—maybe never!

And, after having used two-inch stacks, or risers, for a long time, he learns that 1½-inch stacks will pass inspection. Or having used 2-2&1 SEU, he finds that 1-3 meets the requirements. Brother, it's a wonder this guy has kept going as long as he did! He needs help but no one does anything about it; if he goes broke, there will be a dozen more to take his place—need the supplier care?

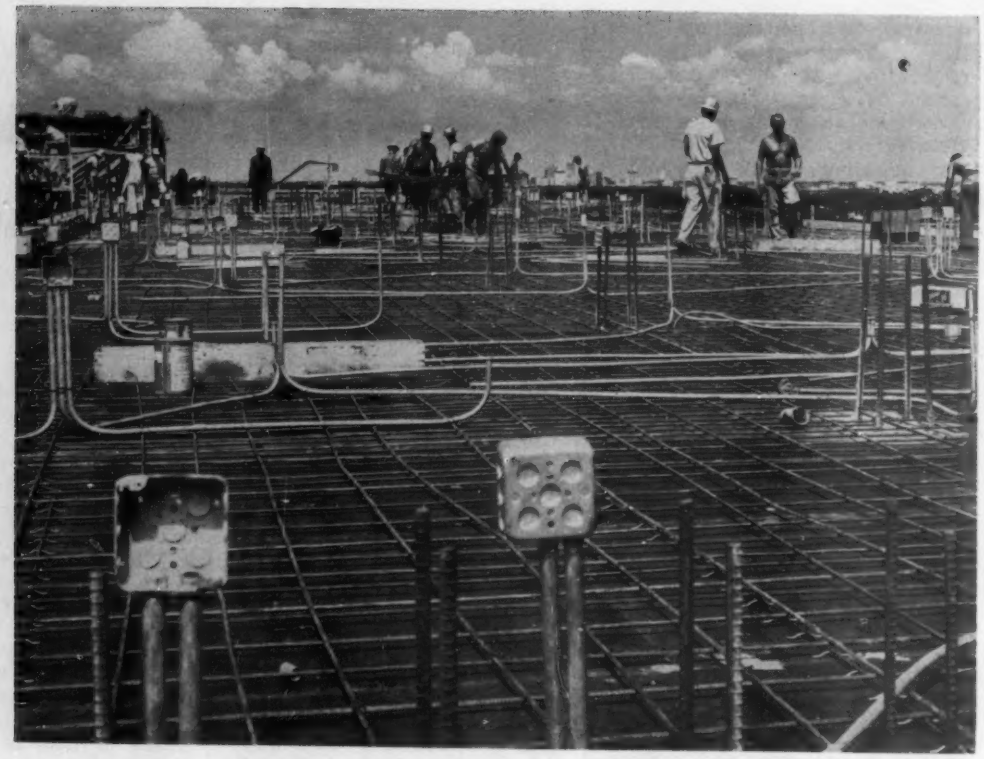
Supplier should care

Yes, I believe the supplier should care and should call a meeting in his office (with free coffee) inviting all small contractors in on a Saturday morning, once a month—to go over gripes and discuss suggestions, consider problems, and distribute information! Whoever heard of such a thing? Well—why not? Everybody would benefit!

The wholesaler would learn a few things about his own operations that might be correctible, and the small contractors also would learn many things to their profit. If I were a supplier I believe I'd spend just a little of the profit, which these contractors are bringing me, for the contractors' benefit—plow it back, as the farmers do. Here's what I'd try to do:

Learn the different ways I could help these contractors to earn more, to save on purchases, and to increase their efficiency. I'd run a contest, continuously, collecting ideas regarding the electrical contracting business. I would collect information weekly from electrical inspectors in the area as to why various jobs were turned

(Continued on page 112)



Aluminum conduit can be seen on floor, before concrete was poured. Miami is in background.

Two B&W electricians are pulling six #3 aluminum RHW conductors to serve as feeders to apartment panels. Three cables terminated at this point and the other three were connected to panel on the floor above. Nearly 300,000 feet of aluminum cable was needed for the project.

Efficient

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electrical Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors ✓
- Industrial Engineers
- Consulting Engineers ✓

◆ Cutting, threading, and bending aluminum conduit with a well organized "mass production" system proved a time and money saver for B&W Electric Company on the big Southgate Towers job in Miami Beach, Fla.

Most of the 70,000 pounds of aluminum rigid conduit used in the 14-floor, twin-tower apartment building was prepared for installation on the ground level by one man who stored it in bins according to size and length. From this stock of bent and straight

Most cutting, threading, and bending was done at ground level, but hickey could make bends.

use of aluminum speeds installation

lengths, requirements for each floor could be quickly selected and delivered by hoist.

The contractor states that this efficient system, along with the easier handling of aluminum, greatly speeded up the conduit phase of the electrical installation. Threading was done with standard steel conduit dies and regular cutting oil.

Aluminum conduit up to four inches in diameter was used in the installation, although a majority of it — 150,000 feet — was ½-inch.

Nearly 300,000 feet of feeder and sub-feeder cables serving the two buildings are also aluminum in sizes ranging from #6 to 700 MCM.

Southgate Towers, which opened its 550 units for occupancy in 1960, is one of the South's largest rental apartment facilities. All aluminum cable and conduit was supplied by Kaiser Aluminum & Chemical

(Continued on page 112)

The electrical contractor for the 550-unit, $7,000,000, twin-building Southgate Towers Apartments in Miami Beach was the B&W Electric Co.

Southern Section Code questions

This is the concluding group of Code questions that were answered at the recent Houston meeting of the Southern Section, IAEI

(38) **Statement:** On wiring devices there are different colored terminals, for connections. For example, on receptacles there are a silver terminal and a brass terminal.

Question: Does the Code require the neutral (or grounded conductor) to be connected to the silver terminal and the hot wire to be connected to the brass terminal?

Answer: Yes. See Sections 200-9 and 10.

(39) **Question:** Would use of the Buchanon new pressure Romex connector eliminate the necessity of reducing the number of conductors in an outlet box?

Answer: No. See 370-6.

(40) Section 200-7.

Question: Is it permissible to use two-wire Romex, with equipment grounding conductor, for ranges and built-in ovens if the requirements of this section are met?

Answer: Yes.

(41) Section 310-12 (note 8).

Question: What derating factor is applicable if a conduit contains eight conductors which compose four two-wire 230-volt branch circuits?

Answer: 70%. If, however, they are motor branch circuits, they must have a capacity of 125% of motor F.L. ratings.

(42) Section 220-4(d). Problems in chapter 9, examples 1;1(a);1(b); 1(c); concern single family service calculations.

Question: Is it the intent of the Code that the neutral conductors carrying capacity equal that of the hot conductors?

Answer: No. Clarification is in order to permit smaller conductors, specifically.

Question: Under what conditions may a service neutral conductor be smaller than No. 6?

Answer: Include same calculations as in examples. See 230-41 (exception 5).

(43) Section 516-2(c).

Question: Are space heating cables which are imbedded in plaster ceilings and covered with ¾ inches of plaster or in concrete floors covered in two inches of concrete, permitted in paint spray rooms or booths?

Answer: Yes. Use bulb and bellows type of thermostats in the paint spray rooms, only.

(44) **Statement:** Circuit conductors serving baseboard or panel heaters are permitted to be types TW, R, or RW insulations at 60 C. Terminal connections are required to be made with at least 75 C RH or THW insulations.

Question: How long do these taps have to be or how far must the higher insulations be extended from the terminals?

Answer: One foot at least. See section 410-65(d)2.

(45) **Question:** In a dwelling type occupancy having a bathroom in the basement, what is the proper method of using a receptacle, in the bath fixture, that is of the parallel blade type?

Answer: Grounding type receptacle is required. See 210-22(b) "other locations" which includes conductive locations.

Question: Is a grounding type receptacle, separate from the fixture, required?

Answer: No.

(46) Sections 220-2(b), 220-2(c).

Question: Why is "shall" used in one place and "may" in the exception?

Answer: In one instance reference is made to branch circuits and the other to feeders. See answer to No. 29.

(47) **Statement:** Some 3 3P.3 fuse approved service switches contain no provisions for attachment of a grounding conductor to the switch enclosure.

Question (A): Are manufacturers required to provide means for attachment of grounding conductor?

Answer: No. U.L. does not require.

Question (B): If the answer to (A) is no, how shall this connection be made?

Answer: See the several methods in sections 250-71 and 72.

(48) **Statement:** An infra-red type heater using a quartz tube, enclosed heater coil, is installed over a hazardous location, such as at service station islands, and is mounted 12 feet above ground. The quartz tube apparently provides protection from physical injury.

Question: Would it be required to provide a lens or screen to meet requirements of 511-6?

Answer: The Code did not contemplate this type of appliance, however if provided with means to prevent hot particles from falling and otherwise conforms to sections 511-6(a and b) it would not appear to be a violation.

(49) **Statement:** A number of complaints are reported of clothes dryers on branch circuits with 30-amp overcurrent devices, probably due to excessive voltage on heater coils. It is suggested that these appliances be supplied by individual branch circuits having a capacity at 125%.

Answer: Appropriate proposals were adopted, to meet the condition.

(50) Section 220-3(b).

Question: This section prohibits connection of clock outlets on the small appliance branch circuits in the kitchens, etc., what are the reasons for this?

Answer: There is no prohibition against plugging clocks into receptacles on these branch circuits, separate *outlets* for clocks on them are prohibited, however, because "such circuits shall serve no other outlets."

(51) **Question:** Have all circuit breaker manufacturers submitted and obtained approval on type NI circuit breaker frames?

Answer: A majority have a portion of their lines submitted.

(Continued on page 112)

Frank Hoag, purchasing agent, checks the stockroom for materials which will be needed on an upcoming job.

Contracting success factors

Volume buying and close checking help assure profits for contractor

Neil mechanics are finishing a tie-in job on switches, panels, and receptacles at an apartment project.

This article should be especially helpful to the following readers:

- Electrical Contractors ✔
- Electrical Utilities
- Electrical Wholesalers ✔
- Electrical Inspectors
- Industrial Engineers
- Consulting Engineers

By Allen H. Fleitell, President, Neil Electric Co., Brentwood, Md.

◆ Buying is the secret to profitable electrical contracting in new construction. Very large volume buying enables us to buy at good prices, offsetting a lower rate of return.

As specialists in new apartment construction, we are set up with control systems geared in every phase to make jobs pay off. This year we expect to top a $1,000,000 volume after four years in this specialty.

We buy locally in monthly quantities, shopping for price. When salesmen call, we supply lists and get price quotations. Factory representatives sometimes accompany the jobber salesmen. By March 1, we have already purchased most of the necessary materials for the entire year for jobs under contract. Materials are shipped and billed monthly.

We believe that if you discount your bills, you cannot do any better buying out of town. It is very important to check your sources of supply because one item may be cheaper one month at one jobber, and the same item may be cheaper at another jobber the following month. Saving even a few cents per item may run into saving hundreds of dollars. As every contractor knows, to get a job you have to start off with a good price.

Local buying also means fast service from a supplier on an item that we may not stock, or do not have on hand at present.

Efficient job control is also vital to profit. We have worked out our own tables of labor hours on specific jobs. Checking jobs constantly and periodically to learn progress and successive stages, we keep trips to jobs at a minimum. Our men call in when material is needed, and this is readied for delivery the following morning.

(Continued on page 110)

Dairy plant wired without blueprints

Over five miles of wire was used in this job to bring power for operating equipment used to process a delicate commodity

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electrical Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors
- Industrial Engineers
- Consulting Engineers

By C. Thomas, Electrical South Field Editor, El Paso, Texas.

◆ Hodges Electric Co., Inc., 7349 N. Loop Rd., El Paso, recently completed an unusual job at Island Dairies, Fabens, Texas.

The most unusual part of this job was that there were never any blueprints drawn—not even a crude sketch—although the job involved more than five miles of wire and between 250 and 300 outlets.

No plans, no bids—this was a time and materials job, the ninth of as many similar jobs in the area, and it was completed by one job superintendent and one journeyman within six weeks.

Eight men, with a winch, were employed in bringing in the service a distance of 332 feet.

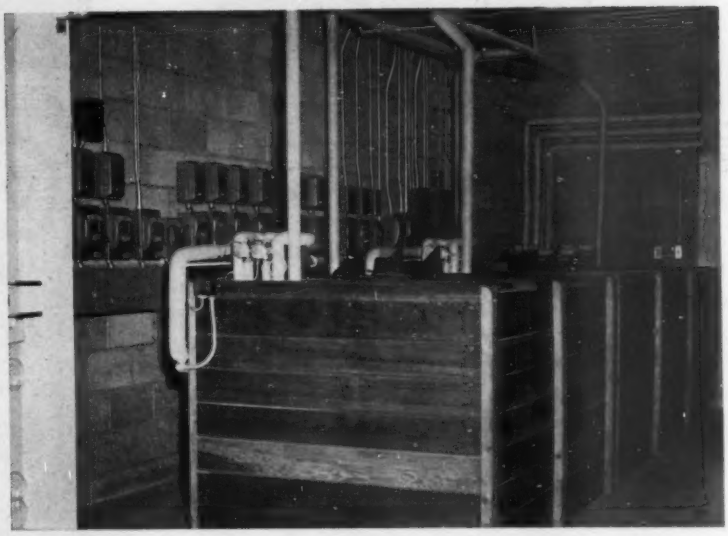
"We worked hand-in-glove with R. O. Pennington Refrigeration Co.," said Paul Hodges, owner of the electric firm, "as we did on the previous eight other dairy farm jobs—some larger, some smaller than this one."

Like Hodges Electric Co., Ray Pennington goes on these jobs without plans, bids, or sketches.

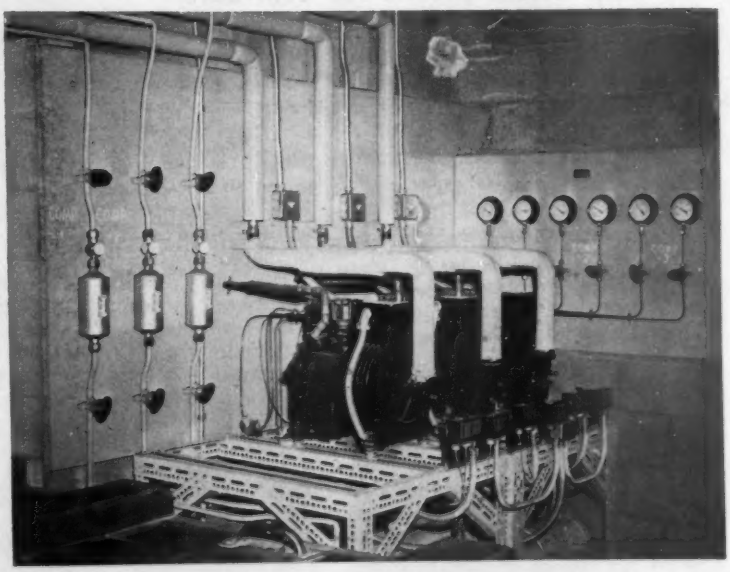
"I ask only four questions before starting one of this type jobs," said Mr. Pennington: "(1) How many cows to milk? (2) Are you going to use cold water for cooling? (3) Are you going to use an aerator to cool the milk? (4) Type of power — single- or three-phase?"

Electrical contractors considering modern dairy farm installa-

(Continued on page 111)



Switch boxes are banked behind the chillers. Wiring for this dairy was done without blueprints, even though it needed five miles of wire.



Compressors are raised above the floor, because the floor must be easily washed and scrubbed down to conform to sanitary requirements. This is the ninth dairy wiring job for the electrical contracting firm.

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Application of Code requirements

Discussion this month covers resistors and reactors, wiring for storage batteries, and begins study of hazardous locations

This article should be especially helpful to the following readers:

- Electrical Contractors
- Electrical Utilities
- Electrical Wholesalers
- Electrical Inspectors
- Industrial Engineers
- Consulting Engineers

By Walter R. Stone, Contributing Editor on Code Rules, Utica, N. Y.

◆ Resistors and reactors are prohibited by Section 470-1 from being placed where they would be exposed to physical damage.

Where they are more than a foot from, but in the immediate vicinity of, easily ignitible material, they are required to be installed in metal enclosures or be of the oil-immersed type. Where they are located within one foot of combustible material, they are required by Section 470-3 to be attached to a panel of noncombustible, nonabsorptive material, such as slate, marble, or soapstone which extends beyond the edges of the resistors or reactors.

This panel, or slab, is required to be a minimum of ½ inch thick with an increase in thickness proportional to the size and weight of the resistor or reactor. The panel is required to be supported independently of the fastening devices which are used to fasten the resistor or reactor to the panel.

Bolts which support the resistor or reactor to the panel are required to be countersunk on the back side of the panel facing the combustible material to a depth of not less than 1/8 inch, and the countersink is required to be filled with insulating material.

Reactors are required by Section 470-5 to be composed of noncombustible material and mounted on noncombustible bases. Enclosures for resistors or reactors are required by Section 470-6 to be so designed that they make contact only at points of support where mounted on plain surfaces so that a minimum of ¼-inch air space is maintained between the enclosures and the surfaces.

Lamps as resistors

Incandescent lamps are permitted by Section 470-8 to be used as protective resistors for automatic controllers and, by special permission, as resistors in series with other devices provided that (a) they are mounted in porcelain lampholders on noncombustible

Code test questions

1. Where resistors or reactors are in the immediate vicinity of easily ignitible material, they are required to be of the oil-immersed type if not enclosed within metal boxes or cabinets. True or false?

2. Incandescent lamps may be used as protective resistors for automatic controllers. True or false?

3. Nominal lead-acid type storage battery voltage is 2.5 volts per cell. True or false?

4. Cells in sealed glass jars require additional insulation unless mounted on wood trays. True or false?

5. Separate battery rooms or enclosures are required only for batteries or unsealed jars and tanks where the aggregate capacity at the eight-hour discharge rate exceeds five kilowatthours. True or false?

6. Resistor or reactor enclosures, when mounted on plain surfaces, shall make contact with such surfaces only at the points of support, leaving a required air space between the enclosures and surfaces of at least:
   (a) ⅛ inch.
   (b) ¼ inch.
   (c) ½ inch.
   Which is correct? a? b? or c?

7. Where resistors or reactors are mounted on slabs within one foot of combustible material, supporting bolts shall be countersunk on the side facing the combustible material to a depth below the surface of at least:
   (a) ⅛ inch.
   (b) ¼ inch.
   (c) ½ inch.
   Which is correct? a? b? or c?

8. A slab on which resistors or reactors are mounted is required to have a thickness proportional to the size and weight of the device but in no case less than:
   (a) ⅛ inch.
   (b) ¼ inch.
   (c) ½ inch.
   Which is correct? a? b? or c?

9. The conductors used in battery rooms:
   (a) may be varnished cambric covered Type V.
   (b) shall be varnished cambric covered Type V.
   (c) shall not be varnished cambric covered Type V.
   Which is correct? a? b? or c?

10. Where a metal raceway is used in a battery room and the enclosed conductor is connected to a battery terminal, the end of the conductor near the battery cell must be free of the raceway for a distance of at least:
   (a) 6 inches.
   (b) 12 inches.
   (c) 18 inches.
   Which is correct? a? b? or c?

Correct answers may be found at end of article on page 110.

Exterior of Prudential's new building, one of the show places of southern New Jersey.

Architect: Frank Grad & Sons, Newark, N.J.
General Contractor: Massett Building Company, Atlantic City, N.J.
Electrical Contractor: William E. Snell Electrical Construction Company, Vineland, N.J.
SPANG Distributor: Serv-U-Electric Company, Penns Grove, N.J.

◀ Superintendent George Hess reviews wiring blue print at job site. Spang Conduit provides top-quality wiring protection in new Prudential Life Building. These two-story facilities provide 200,000 sq. ft. of space, house 1,000 employees, cost $3,000,000.

Q. "WHAT DO YOU THINK OF SPANG CONDUIT QUALITY, MR. HESS?"

A. "SPANG is uniform in diameter and straightness, and the finish is very good!"

SPANG CONDUIT

That's George Hess speaking. He was superintendent for William E. Snell Electrical Construction Company, Vineland, N.J. We interviewed him and Howard Franz, Snell field representative, at the new Prudential Life Insurance Company of America Building at Linwood, N.J., where they were making a SPANG Steel Conduit installation.

Mr. Franz said, "SPANG Conduit bends, threads and cuts well. The galvanized finish doesn't chip, crack or blister during bending. We've had no problems of white rust or other corrosion, even in this salt-air region.

"SPANG has a smooth interior finish—no burrs, snags or imperfections to cause wire-pulling problems. We know this installation will last the life of the building."

That's SPANG quality at work!

. . . and it will work for you, too—in SPANG Steel HD Galvanized, SPANG Steel Black Enameled, SPANGLEAM EMT and SPANG Rigid Aluminum Conduit. Try them and see! For quality service on all your electrical requirements, call your nearby SPANG Distributor.

SPANG Conduit is one of the many fine products produced by *National Supply Division, Armco Steel Corporation, Two Gateway Center, Pittsburgh 22, Pennsylvania.*

ARMCO National Supply Division

supports; (b) they are so arranged that they cannot be supplied with a voltage higher than that for which they are designed; (c) they are provided with a permanent nameplate giving the voltage of the lamp to be used in each lampholder; and (d) they do not carry or control the main current nor act as the regulating resistance of any device.

Section 470-7 requires that insulated conductors which are used between resistors and controllers be rated at 90 C (194 F) unless the resistor is used for motor starting only. For motor starting duty, as distinct from motor regulating duty, the resistor is not in the circuit long enough, usually, for the temperature to damage conductors rated at 75 C, or even 60 C in some cases.

For elevator motor starting service, the conductors from the panel to the main circuit resistors are required by Section 620-11(a) to be rated at not less than 90 C. (For a discussion of rheostats in connection with motor controllers. see the October, 1960, issue of ELECTRICAL SOUTH).

Storage batteries

Special provisions for storage batteries are listed in Article 480 of the Code. The provisions of this article apply to all stationary installations of storage batteries using either acid or alkali as the electrolyte and consisting of two or more cells in series with a nominal potential in excess of 16 volts. The nominal potential for a lead-acid battery is two volts per cell, and for an alkali type it is 1.2 volts per cell.

In general, wiring and equipment supplied by storage batteries are subject to the same Code requirements as similar wiring and equipment of the same voltage supplied by other power sources except for a few special rules which apply only to the batteries themselves and to the interior of battery rooms where corrosive fumes are prevalent.

Potential under 250 volts

Batteries are required to have supports of insulating material. For batteries with cells so connected that the total voltage does not exceed 250 volts, the following insulated supports are required:

(1) Lead-acid batteries having cells in lead-lined wood tanks are required to be supported individually on glass or glazed porcelain insulators where the number of cells in series is 25 or less, and on oil insulators where the number of cells in series exceeds 25.

(2) Alkali type batteries having cells in jars which are made of conducting materials are required to be supported by trays of nonconducting material with not more than 20 cells in series to each tray, or the cells may be supported either individually or in groups on porcelain insulators or on other suitable insulators, such as glass or oil type insulators.

(3) Cells in unsealed jars which are made of non-conductive material are required to be assembled and supported by trays of glass or supported by glass or glazed porcelain insulators. Where cells are installed on a rack, such insulators may support the cells individually or in groups.

(4) Cells in sealed rubber or composition containers are not required to have insulating supports where the total potential of all the cells does not exceed 150 volts. Where the total potential does exceed 150 volts, the battery is required to be divided into sections of 150 volts or less. The cells in each such section are then required to be individually supported by trays or racks. Such trays or racks are, themselves, required to be supported by glass or glazed porcelain insulators or oil type insulators.

(5) Cells in sealed glass jars or in sealed jars of heat-resistant plastic, with or without wood trays, do not require additional insulation.

Potential over 250 volts

For batteries with cells so connected that the total potential exceeds 250 volts, the cells are required to be installed in groups of not over 250 volts, and each such group is required to be supported by trays or racks with the trays or racks, themselves, supported by oil type insulators except as follows:

(1) Where each individual cell or sub-group of cells is supported on oil type insulators, no additional insulators are required for the trays or racks.

(2) Cells of ten-ampere hours or less and having a total potential of 500 volts or less which are in sealed glass jars are permitted to be divided into groups of 250 volts or less and mounted on trays with the trays, themselves, supported by glass or glazed porcelain insulators. The trays are then required to be mounted on racks with the racks, themselves, supported by oil type insulators.

A fine print note following Section 480-5 states, "Maximum protection is secured by sectionalizing high voltage batteries into cell groups insulated from each other."

The racks required by this article of the Code can be either wood or metal or other suitable frames designed to support cells or trays which are so treated as to be resistant to the deteriorating action of the electrolyte. When such racks are metal, nonconducting members, or supports, are required for the cells.

The trays referred to can be frames of wood or other nonconducting material so treated as to be resistant to the deteriorating action of the electrolyte and designed to support the cells.

Separate battery rooms or enclosures are required by Section 480-7 ". . . only for batteries in unsealed jars and tanks where the aggregate capacity at the eight-hour discharge rate exceeds five kilowatthours." Sufficient ventilation is required to prevent the accumulation of an explosive mixture of gases in such battery rooms. Overcharging of the batteries can cause an explosive mixture of hydrogen and oxygen gases to be given off into the room.

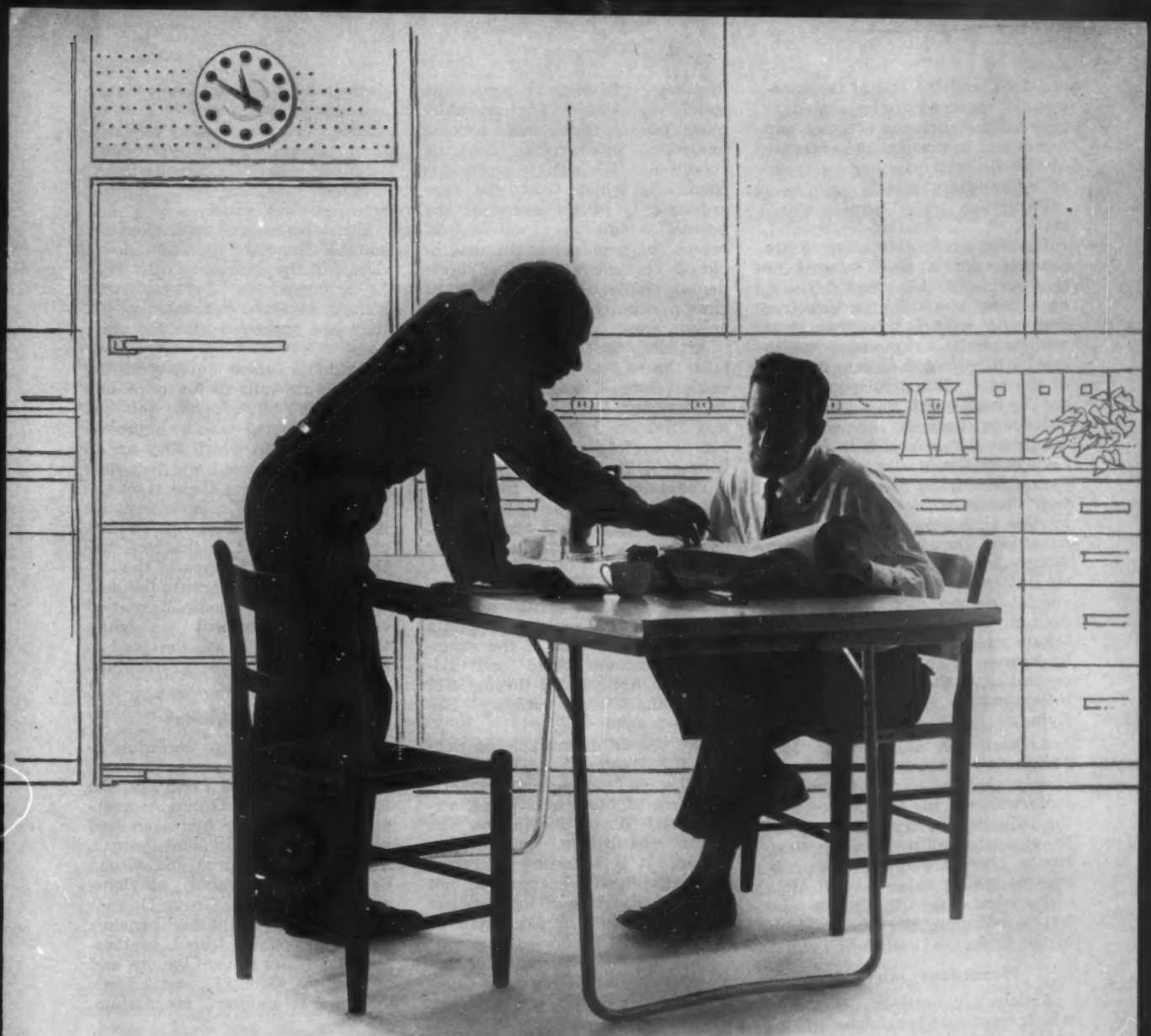
Wiring method

The wiring method in storage battery rooms is required to be either bare conductors, open wiring, Type MI cable, rigid conduit, or EMT. Rigid conduit or EMT is required to be of corrosion-resistant material or be protected by a corrosion-resistant covering. Aluminum, copper, and Everdur steel raceways, as well as galvanized steel raceways which are provided with plastic coatings or with asphalt-base paint coatings, are usually satisfactory for this purpose.

Where bare conductors are used, they are not permitted to be taped. Type V varnished cambric covered conductors are not permitted to be used at all in battery rooms.

Care is required to be exercised in terminating metal raceways near battery cells. The raceway is required to be terminated approximately one foot away from the terminal connection so that at least 12 inches of conductor extends beyond the raceway for the connection to the battery cell.

A glazed insulating bushing is



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required, and the end of the raceway is required to be sealed to prevent the entrance of gases and fumes and to prevent the entrance of the electrolyte either by spray or by capillary action.

Paragraph (f) of Section 480-7 states, ". . . Sealing compound, rubber insulating tape or other suitable material shall be used for this purpose." It is more difficult, of course, to obtain an effective seal with rubber tape than it is with a sealing compound which can be firmly pressed into the end of the pipe. But a cone-type seal can be made with tape.

Various hazards, or potential hazards, are referred to in the Code from time to time in relation to equipment and its uses. But the term "hazardous location," as used in the Code, means one of the hazardous locations defined in Article 500. This is the first article in Chapter 5. Chapter 5 covers special occupancies. Article 500 defines, and is concerned with, occupancies which are "special" by reason of the hazardous concentration in the areas involved of inflammable vapors, dusts, or flyings.

Articles 500, 501 through 503, 510, and 511 through 517 are very closely related and frequently "interwoven" in the sense that the rules in one frequently apply to equipment listed in another. Hence, there are many cross-references among these several articles—more than usually are encountered among the other articles of the Code.

Hazardous mixtures

Article 500 outlines the things which constitute hazardous atmospheric mixtures and divides these mixtures into groups according to the type of mixture, such as whether a particular dust is conductive or not, the degree of combustibility, or the ignition temperature, and the potential explosive force—in short, according to the general degree of hazardousness.

These groups are designated as Group A through Group G. The hazardous areas are also divided into three classes. Class I represents areas containing gases and includes Groups A, B, C, and D. Class II represents areas containing dusts and includes Groups E, F, and G. Class III represents areas containing lint or flyings. There are no group designations in Class III locations.

Each class is divided into two divisions. Division 1 represents conditions which are normally hazardous, or which could become hazardous under usual operating conditions. Division 2 represents conditions which would be hazardous only in the event of abnormal conditions, such as by reason of accidental rupture of closed containers or other accidental causes, or by reason of close proximity to a normally hazardous area.

Articles 501, 502, and 503 stipulate the rules for wiring and equipment in Classes I, II, and III respectively for both Division 1 and Division 2 locations. Article 510 is prefatory to Articles 511 through 517.

The latter spell out more specifically the details involved in certain commonly encountered hazardous areas, such as service stations, hospital operating rooms, etc., and the extent of their boundaries, as well as the special rules for wiring and equipment within the boundaries. All of the exemplary locations listed and discussed in Articles 511 through 517 are in the Class I category. See Figure 1.

The second paragraph of Section 500-2 states, ". . . The characteristics of various atmospheric mixtures of hazardous gases, vapors and dusts depend on the specific hazardous material involved. It is necessary therefore that equipment be approved not only for the class of location but also for the specific gas, vapor or dust that will be present."

This is very important, for explosions resulting from some types of gases (or dusts) are far more destructive than explosions resulting from other types. For instance, acetylene is more powerful than gasoline and therefore needs stronger enclosures to contain explosions resulting from it than from gasoline vapors.

Some equipment enclosures are suitable for more than one gas or dust, but the enclosures used must be approved for the particular hazard involved whether or not they are approved also for other uses.

Similarly, some equipment enclosures are suitable for more than one class. But, again, the enclosures selected must be approved for the class in which they are to be used. Equipment which is suitable for use where there is an explosive gas, for instance, usually is not suitable also for an explosive dust—not, in this case, because of the difference in the explosive force, but because the dust would cover it completely and cause it to overheat and ignite the dust unless it was designed to operate at a safe temperature under such conditions.

Mixture groups

The various groups according to the atmospheric mixtures involved are divided by the Code into the following groups: Group A: acetylene; Group B: hydrogen and vapors of an equivalent hazard, such as manufactured gas; Group C: ethyl-ether vapor, ethylene, and cyclo-propane; Group D: gasoline, hexane, naphtha, benzine, butane, propane, alcohol, acetone, benzol, lacquer solvent vapors, and natural gas; Group E: metal dusts, including aluminum, magnesium,

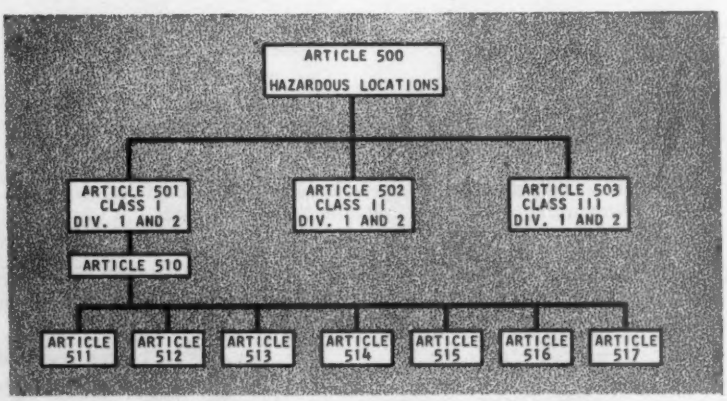


Fig. 1—Article 500 concerns hazardous locations generally. Articles 501 through 503 concern Classes I, II, and III, respectively. Article 510 is prefatory to Articles 511 through 517 which concern exemplary location in Class I areas. These articles are closely related.

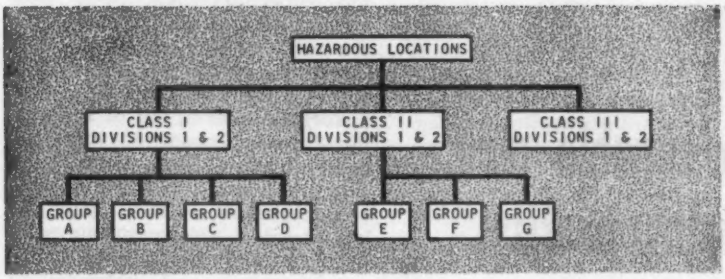


Fig. 2—Atmospheric mixtures are grouped according to degree of hazardousness. Groups A through D are in Class I and represent gases. Groups E through G are in Class II and represent dusts. Class III represents lints and flyings but is not further divided into groups.

and their commercial alloys, and other metals having similar characteristics; Group F: carbon black, coal, and coke; and Group G: flour, starch and other grain dusts. See Figure 2.

The first paragraph of Section 500-2 states, "The intent of Articles 500-503 is to require a form of construction of equipment, and of installation that will insure safe performance under conditions of proper use and maintenance. It, therefore, is assumed that inspection authorities and users will exercise more than ordinary care with regard to installation and maintenance . . ."

This paragraph of the Code is loaded with meaning and importance. In effect, it stipulates that all equipment used must be of a type which is suitable and safe as used; that it must be installed in a suitable and safe manner; and that it must be suitably maintained and kept in a safe condition as long as it is in use.

After listing the groups into which the various atmospheric mixtures belong, the Code does not refer again to any specific groups. The Underwriters' Laboratories, Inc., lists equipment according to the group or groups for which tests indicate it to be suitable, and inspection authorities check closely for these group markings.

But the Code, after once making the designations and making it mandatory for equipment to be approved for use in the group in which it is used, proceeds to enlarge upon the requirements for the different classes without further reference to the various groups. A discussion of these requirements will be continued in the next issue of ELECTRICAL SOUTH.

(Continued on page 110)

Questions on the Code

(Readers are invited to send in questions which they would like to see discussed in this department.)

Is charging equipment hazardous in driveway?

QUESTION: I do not understand Section 503-15 which governs battery charging equipment in hazardous locations. I have always tried to follow Code requirements, but this is not a reasonable requirement. My customer wants this equipment in the driveway where I have seen thousands of others installed and used. Please explain this Code rule.

ANSWER: Section 503-15 governs storage battery charging equipment only when such equipment is installed in Class III locations. Such a location is hazardous by reason of the presence of specially combustible flyings or lint.

These requirements are not unreasonable when applied to such a location. If the equipment is to be installed in a non-hazardous location, the requirements of this section do not apply. Charging equipment is not permitted at all in Class I or in Class II locations.

It is permitted above such locations, however, as may be noted by the provisions of Section 513-9 for aircraft hangers and Section 511-7 for commercial garages.

Your reference to driveways leads me to believe that the storage battery charging equipment is to be installed in a commercial garage or in a service station. If so, such equipment must be not less than 18 inches above the level of the driveway.

The wiring to battery charging equipment above the hazardous area in commercial garages is governed by Section 511-5. Either a metallic raceway or type MI cable is required as the wiring method. A grounded type receptacle is required.

How does switchboard differ from panelboard?

QUESTION: What distinguishes a switchboard from a panelboard? I have submitted plans for approval showing the service equipment against a wall. The inspector will not approve this, giving as his reason the need for clearance behind the switchboard.

I contend that it is a panelboard and therefore acceptable when mounted against a wall. The Code definition of a switchboard states that switchboards are not intended to be installed in cabinets. This board is entirely enclosed in metal. I would appreciate your opinion.

ANSWER: The Code does say that switchboards " . . . are not intended to be installed in cabinets." It also states that switchboards " . . . are generally accessible from the rear as well as from the front . . . . " The definition for panelboards states that panelboards are " . . . designed to be placed in a cabinet or cutout box placed in or against a wall or partition and accessible only from the front."

There is a difference, however, between a cabinet or cutout box, on the one hand, and a metal enclosure for a switchboard on the other. Hence, the mere fact that the board in question is metal-enclosed does not mean that it is not a switchboard.

Section 230-106 lists metal-enclosed switchgear as comparable to a vault insofar as service overcurrent protection requirements are concerned. Paragraph (6) of this section describes the minimum requirements for such an enclosure. The difference, then, between a switchboard and a panelboard boils down, principally, to accessibility.

If everything connected with the board, including the raceways, is accessible from the front by the removal of the front trim, then it is a panelboard. If some of the equipment and raceways are accessible only from the rear for which removable sections of the metal enclosure have been provided, then it is a switchboard.

A switchboard is *required* to have the clearance specified by Section 384-8. It *should* have, if at all possible, the clearance specified by Section 110-15.

Contractors tell how

Delegating authority to capable men has importance in assuring profits

By John Gabrio, Gabrio Electric Co., St. Petersburg, Fla.

◆ Perhaps no other aspect of the electrical contracting business is as important in assuring profits as the supervision and management of men and materials.

Since this means delegating authority for job operations to capable men, our policy is to select as job superintendents those men who seem worthy of shouldering the responsibility of making decisions affecting job progress in a profitwise direction.

For this reason, out of a working crew of about 30 men, we have appointed ten as foremen. The title is not significant in name only, because with it goes the higher salary commensurate with the heavier responsibilities of supervising men and materials on the job.

Thus, with one for each three workers, a superintendent is charged with the responsibility of turning in a profit. In return, he runs the job as he sees fit. Since our job cost records are kept on a week-to-week basis, it is quickly apparent if the job is slipping, and if this is due to such factors as over-staffing, lack of the super's coordination with other trades, etc.

In delegating responsibility to men, you delegate two things at once—the right to make decisions and the responsibility for backing them up. Once you delegate a job, don't interfere. Let your man grow up to the task you've given him.

Our feeling is that you get more out of your men if you lead them rather than drive them, because a contractor's degree of success—or amount of profit—depends as much on personnel management as on the many other facets of good business procedures.

And about the most difficult thing for a contractor to learn is how to increase his supervision through good management of key workers, and thereby divorce himself from mundane tasks and devote his efforts in the direction of more efficiency and executive planning for his organization.

The incentive of dangling a foremanship before a worthy worker should set up competition against the individual's own efforts rather than against fellow foremen, especially where men on the staff have been working together a long time and each knows the other's potential.

In his superintendent's status, each working foreman takes pride in the fact that he has been entrusted with the execution of a major contract and does his utmost to establish the most affable rapport with his men, without riding them. If the process of selection of key men is used properly and with due regard and study of each super's special abilities, he will be a decided asset. If fore-

Reel simplifies long wire pulls

By Ross Cutting, Ross Electric Service, Cleveland, Ga.

◆ Small contractors usually curtail expenditures for things without which they think they can get along—including reels for efficiently straightening coiled wire instantly with no labor costs.

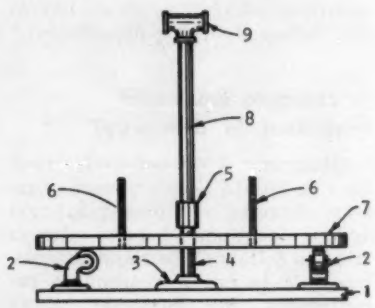
Now, however, they have no excuse for kinky wires or wasted labor. The illustrated wire turntable can be constructed in 90 minutes at a cost of about $2.50 from hardware store materials.

We developed this device recently when wiring 300-foot long Georgia broiler houses. It proved most successful.

Referring to the illustration, parts of the reel are as follows: (1) Baseboard, 1 x 12 to 18 inches, (2) Platform castors having four screw holes in the plates for mounting, (3) ½-inch pipe flange, (4) ½ x 4-inch pipe nipple, (5) ½-inch pipe coupling, (6) ¼-inch threaded rod 8 inches long, (7) Turntable, 1 x 12 to 18 inches, (8) ½-inch pipe 10 inches long, and (9) ½-inch pipe tee.

To assemble parts, first draw diagonal lines from the corners of the baseboard and mount pipe flange in exact center. About this center, circumscribe a nine-inch circle and mount either three or four platform castors at equal distances around the circle. Insert nipple in flange.

Bore a hole in exact center of turntable board. Place turntable on the nipple and give it a whirl. At this stage, your coil of wire will slide to one side, so draw three radial lines from the center of the turntable, 120 degrees (1/3 circle) apart.



This inexpensive and easily built wire reel greatly simplifies wire pulling in extra long conduit runs.

Along each of these lines drill six holes, starting 2½ inches from the center. Taper ends of the eight-inch threaded rods on an emery wheel—just the first five or six threads. With vise grips, turn the three threaded rods into each of the 18 holes to form threads in the wood.

Now screw the pipe coupling into the nipple. Turn the ten-inch pipe into the coupling. Turn the tee into the pipe end.

There's your budget-priced wire reel and the tee makes a convenient handle to carry the loaded reel. The six holes, ½ inch apart, give you options to unreel coils of wire with five-, six-, seven-, eight-, nine-, or ten-inch openings, and the coils will remain quite well centered.

men are chosen on any lesser basis, they can be the downfall of any organization.

The electrical contractor, by the very nature of his business, especially if he is concerned with the bigger jobs and their broader complexity, places much of the responsibility in the hands of his foremen. Without a profound knowledge of their nature, this can be disastrous.

For example, when it comes to estimating labor units on the "close estimate" jobs, it must be obvious that the contractor needs to know which men can most expeditiously handle a given task in the shortest period of time, if any profit is to accrue from it.

It follows, then, that it is wise on such jobs to explain to the men selected that the job has been won on a close estimate for labor, and just why they've been selected to handle it, if you wish to insure their cooperation and guard against excessive labor costs.

Such knowledge stimulates initiative, engenders enthusiasm, and bars resentment in the ranks. Certainly, one of the admitted characteristics of humans is that a person will often do far more and go to greater lengths to please another than he will to please himself.

To this end, when a foreman knows you have reposed responsibility in his performance, and when he knows just why he is doing that particular job and just where he and his men fit into the total company picture, he will work at the important function of finding the most efficient and profitable way to get the job done.

Under our selection system, it has been proved time and time again that our supers literally work overtime at the task of dreaming up practical ideas that save the firm money.

Nor does it hurt to hold periodical social functions at the boss's house and get each worker's family into the act. The wife, particularly, is a powerful motivating factor in keeping the fire of initiative burning in her spouse when it threatens to smolder only.

Today's contractor needs to experiment. He should try routing his men to various jobs, noting their performance and capabilities for various kinds of work. The foreman, too, will emulate this procedure with the men under him, and the net result is certain to be most satisfactory.

Your foremen are your trusted lieutenants. They're the fellows who run the job. Let them make the decisions, and thus save you from wallowing in a morass of trivia and give you the time to know in what direction your business is heading.

Simple but effective method collects past-due accounts

By N. R. Johnston, Bradley's Electric Co., Corpus Christi, Texas.

◆ Sometime ago, in checking over our past-due accounts, we discovered that we had a fairly large number of such accounts ranging from three to six months in arrears.

Totaling up these accounts, we found that there was about $5,800 in past-due bills for which we had received no money, although statements had been mailed and past-due statements followed 30 days later.

Contractor Johnston uses an effective method to collect past-due bills from customers of the Texas firm.

Starting down the list of these old bills, I contacted each customer by telephone, pointing out to him how long his bill was past due and asking him to pay something on the account each month.

The majority of the people want to get the money all together at one time to pay the bill, but they rarely do. Something else always comes up before that, requiring immediate cash, so they continue to put off payment of past-due bills.

Getting a customer on the telephone, I would ask him to pay a certain amount on his account each month, even if it would be only $25, but to send such an amount regularly on the date on which we agreed.

For example, I would say to a customer, "Well, this is the 15th, can I expect $100 on the 20th of this month?"

If the money didn't come in on the specified date, the customer was called back that day and told that the money he had promised to send hadn't been received. This is the best method we have found for collecting these past-due accounts.

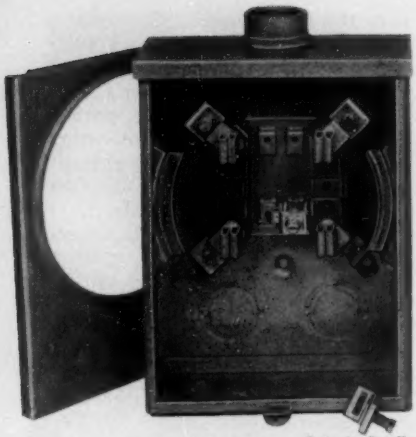
It is important to set a definite date, a specific amount, and not let the debtor slip by one month without a payment. Working our old accounts in this manner, we were able to collect the $5,800 owed us in about six weeks.

Although most form statements say that the total amount is due in 30 days, ours have the notation that payment is due on receipt. After 30 days, we send out a past-due notice. If the bill still isn't paid in a short time, it's time to start calling.

For a customer you have to call, there is no use in sending more than one past-due statement.

We have hopes that some type of collection agency can be formed in our area that electrical contractors can support and use. That would provide a method of handling such accounts, and we wouldn't have to take the time to do it ourselves.

Until such an agency is available, however, we will continue to collect past-due bills by getting customers to pay on installments, and see that they never miss a payment on the pre-arranged date without us contacting them by telephone.



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CATALOG SL-AL-100FH-1 1/4"
Size 10 1/2" x 8" x 3 5/8"
4 Terminals—100 to 120 Ampere
Aluminum Extruded Connectors

Patents Pending
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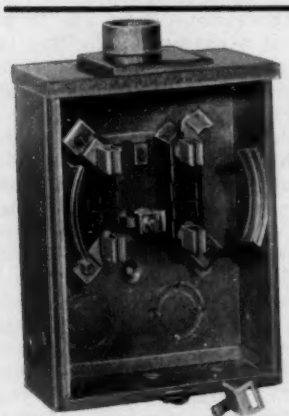

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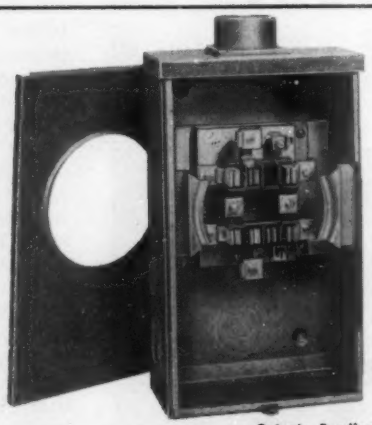
Aluminum Extruded Connectors



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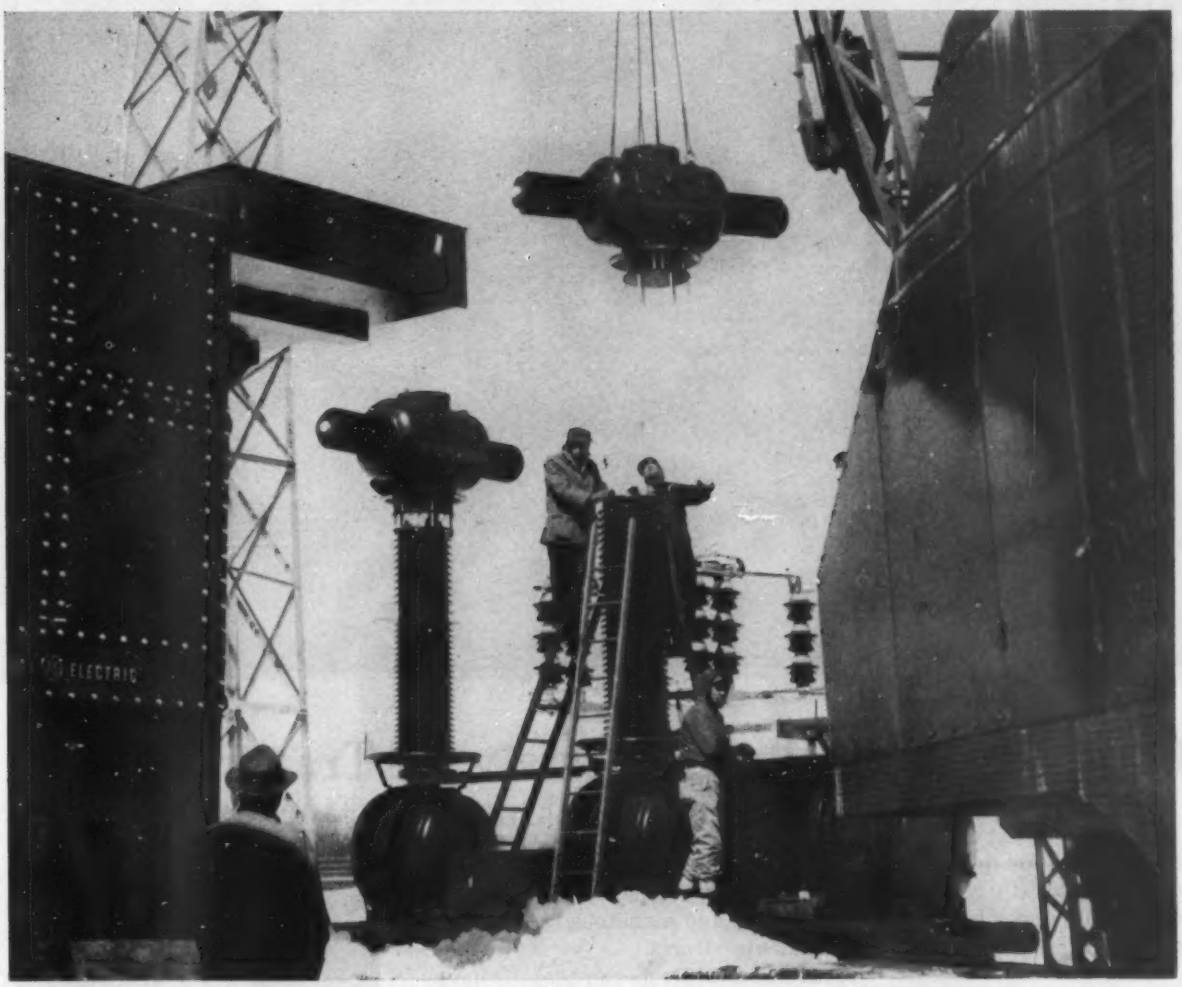
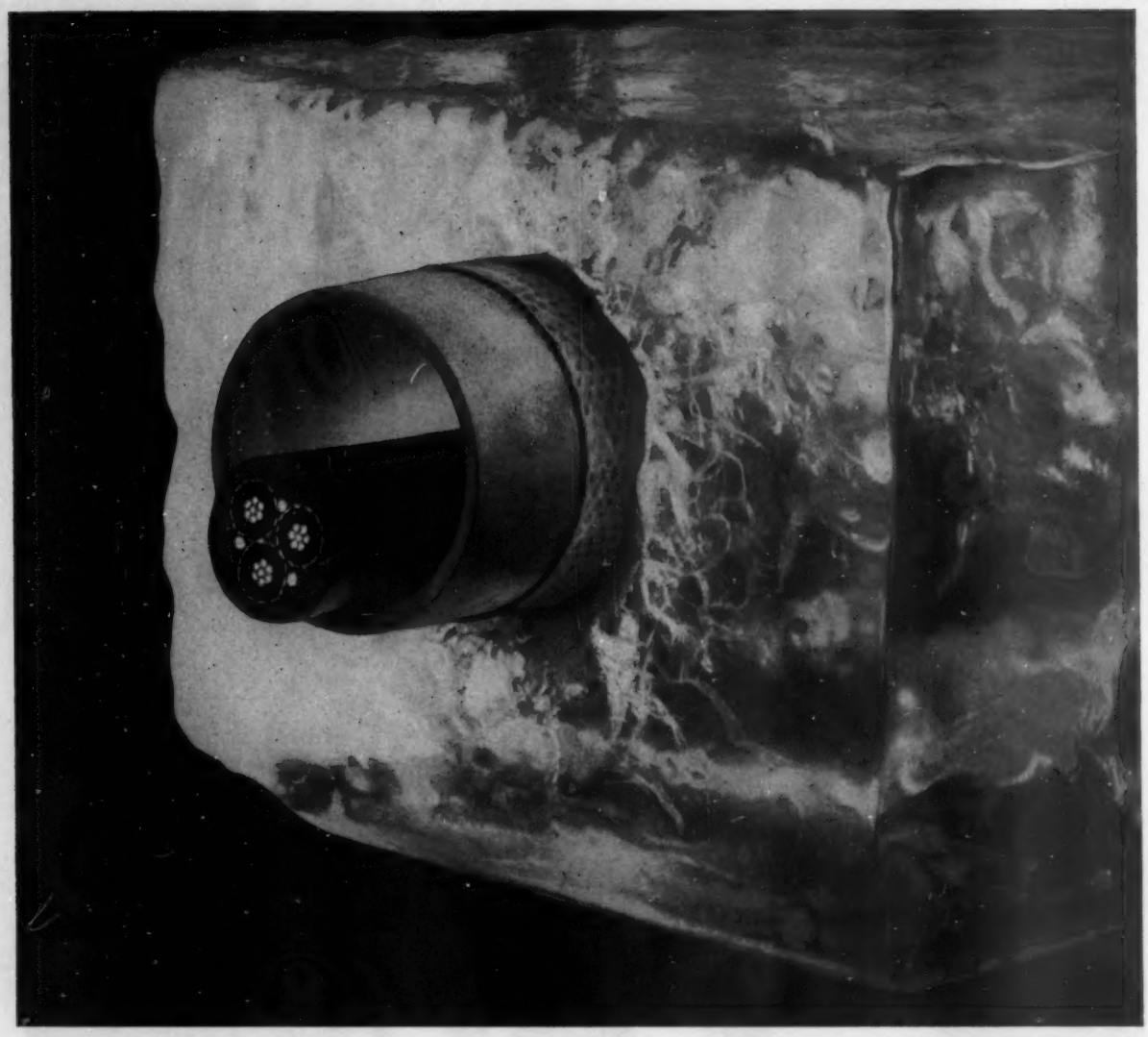


Air-blast breaker heads are lowered into place on G-E's super-high-voltage system

New look at basic impulse levels—page 64
Seven guide EEI Research Division—page 67
Application of substation lightning arresters—page 68
Safe on-the-job driving gets boost—page 70
Effective A-Bug campaign can reduce accident rate—page 71
Economics of loading transformers—page 74
Light helicopter lays cable directly on cross arms—page 76

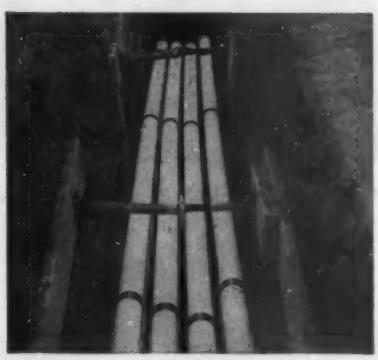


Cooler cables at lowest costs with Transite Ducts!

Do you know that electrical system losses amount to more than four hundred million dollars annually? Research shows that these losses can be drastically reduced by improving the dissipation of heat from conductors under load. The most efficient and economical way to accomplish this is with inorganic Transite® Ducts.

Tests prove that asbestos-cement Transite Ducts can actually have as much as 110.6% greater heat-carrying ability than organic ducts. This means that when a conductor is supplying a given load, its temperature will be substantially lower in Transite. These cooler cables result in lower electrical resistance with correspondingly lower I^2R losses. At a $20/KW cost, this can save you as much as $8.20 per thousand feet a year. Lower operating temperatures mean longer cable life and more reliable service, too!

Because of their 10′ lengths and speedy coupling method, Transite Ducts can be installed at the lowest cost. Get the full story by writing Johns-Manville, Box 14, ES-2, New York 16, N. Y. In Canada: Port Credit, Ontario.



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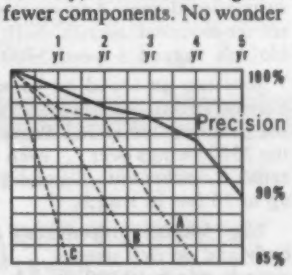
Put this Precision control beside **any** other — and you'll see the difference in simplified, miniaturized, long life engineering and construction. Put Precision on the !ine and save the difference. This control that revolutionized the multiple street lighting system 5 years ago now is used on more installations than any other make at any price.

No other control gives you so much **field proof** of performance under all conditions. No other control approaches the trouble-free simplicity of Precision's two-component circuit.

It is this advanced engineering that insures your system against all fail-out hazards of tubes, transistors, printed circuits, magnetic relays, capacitors, other components of complex photocontrols.

Yet Precision costs less to buy, less in the long run because it uses up to 18 fewer components. No wonder major utilities make the most of modern outdoor lighting with Precision — a truly perfected photocontrol. Write or Wire for Technical Data.



LIFE EXPECTANCY OF LEADING PHOTOCONTROLS

Weatherometer tests and field service prove that Precision outlasts other controls by 1 to 4 years. It pays for itself in replacement labor economies every year.

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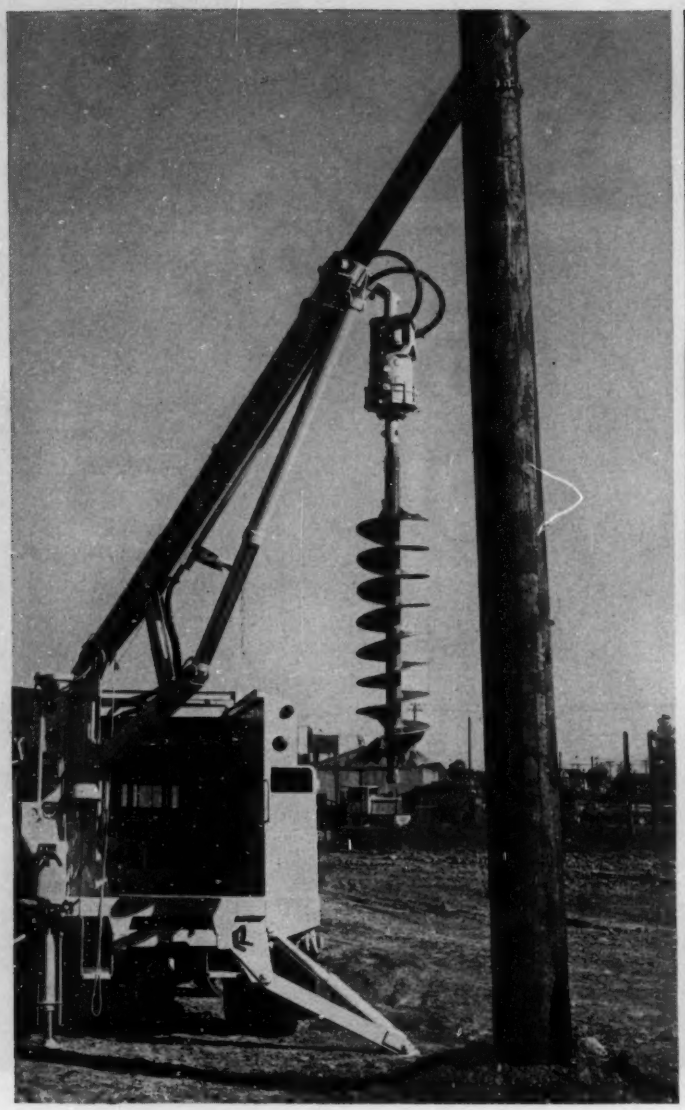
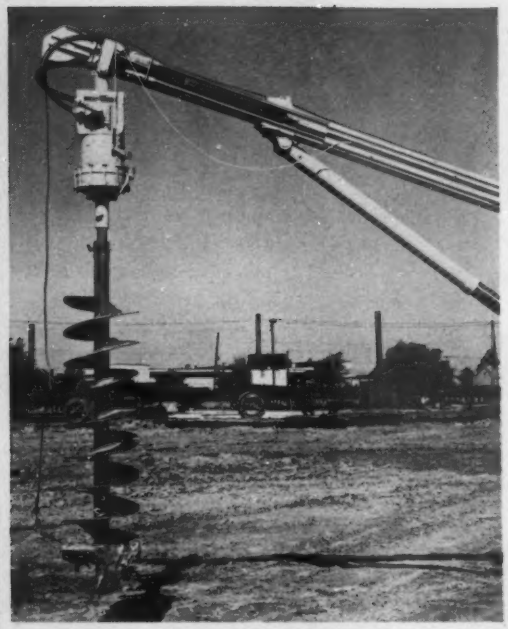
Ridgewood, New Jersey

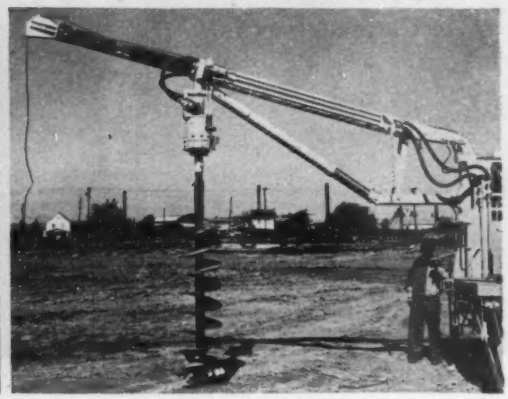
The difference between night and day





Semi-automatic device locks borer on end of extendible boom for digging.

Borer automatically locks to end of main boom when retracted, leaving extendible boom free for pole setting.



Diagnosis: High Feed Pressure

Strongest corner-mounted derrick in the field is Holan's 7500 — a powerful, time-saving derrick that operates in an arc behind and to the right side of the truck.

Here's power . . . real power . . . all the up and down feed pressure needed to drive any derrick-suspended digger. And more than that, it's the only corner-mounted derrick built capable of handling Holan's rugged 3-speed 5400 Earth Borer.

Jobs can go ahead on schedule — even in alleys, narrow streets and congested areas because positioning problems are ended. Parked parallel to the curb, the 7500 swings over . . . even over fences and guard rails . . . reaches out . . . and digs deep holes, sets poles up to 70 feet in length.

The 7500 is engineered as a complete unit to avoid body and derrick stresses . . . can "live boom" 8,500 pounds, winch 10,000 pounds.

A semi-automatic locking device moves the earth borer onto the extendible boom for digging . . . or to its main boom storage position.

The 7500 . . . shown here mounted on the left side . . . is available mounted on the right side. It reaches up 27'-6", 18½' behind the truck, and beyond the right side 12'-3" (left-side mount) and 16'-10" (right-side mount) with boom extended.

Before you buy any corner-mounted derrick, write us — or call your Holan Field Representative — for complete details.

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Get the whole story on America's easiest to install, most versatile Loadcenter. Write I-T-E Circuit Breaker Company, Walker Division, 125 Bennett Street, N.W., Atlanta 9, Georgia. Ask for Bulletin C-63.

The HEART of HOUSEPOWER ⚡ Nerve-Center of The Medallion Home

I-T-E CIRCUIT BREAKER COMPANY
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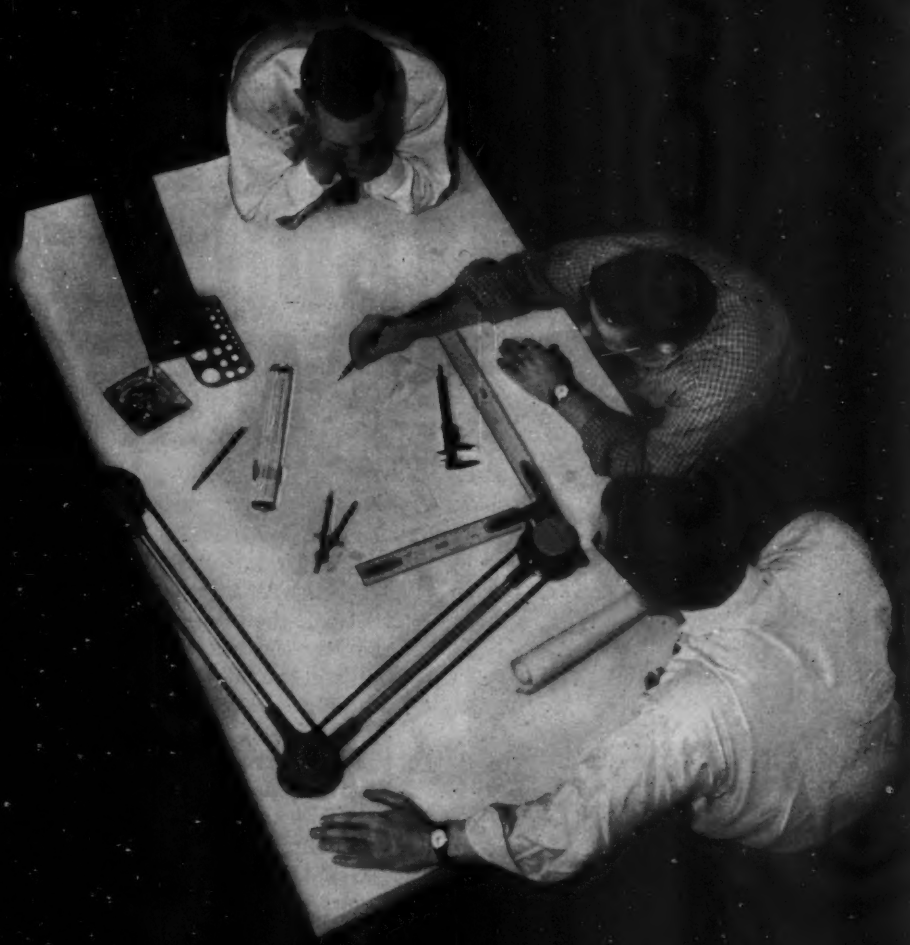
CONCENTRATION



RT&E was founded and operates today on a very basic premise: do one thing and do it better than anyone else. That's why you'll find engineers at RT&E thinking and doing things with transformers that nobody else has ever done . . . why engineering talent at RT&E is concentrated on *one* idea . . . a better transformer. This concentration can pay off for you. Proof? Write for Bulletin 101.

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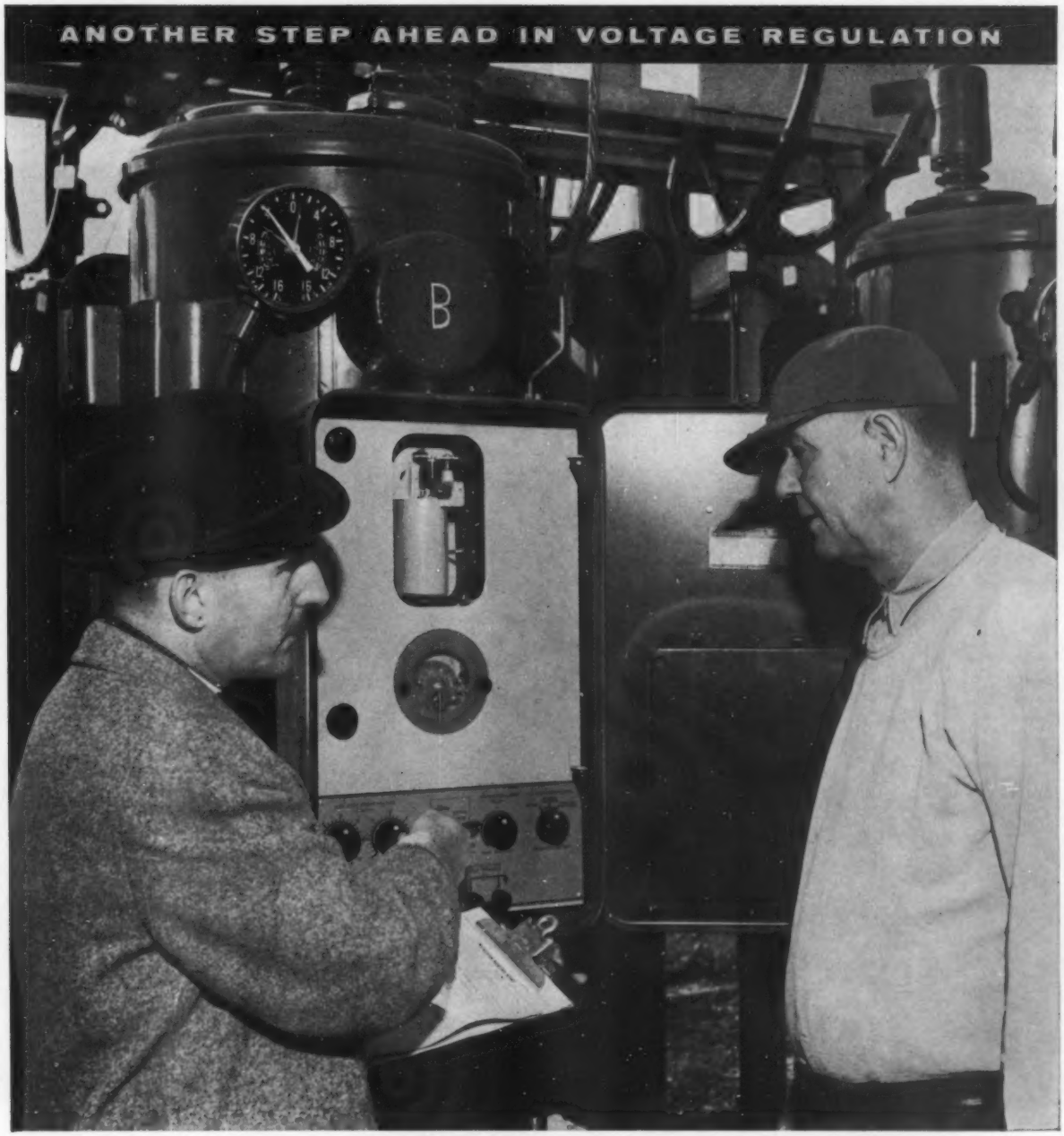

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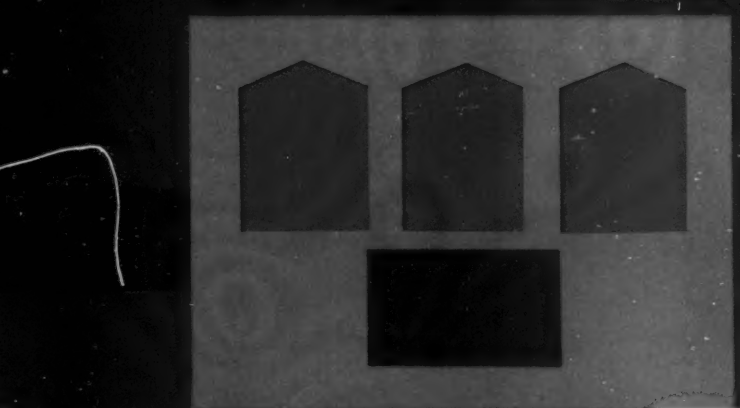
Why Electro-Motive peaking



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When you put the peaking power at the point of load (which can best be done with Electro-Motive Peaking Plants) you gain these five important system improvements.

REDUCED ANNUAL COSTS—You defer investment for new transmission equipment. You generate peaking power without transmission loss.

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power makes sense

the peaking power at the point of load

power . . . practically eliminate preparation-for-peak expenses.

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The logic of decentralized Electro-Motive Peaking Plants can be the answer, if you are looking for the next step in system efficiency. Electro-Motive power can mean substantial savings in many areas of your system operation. For a complete description of all the advantages of decentralized Electro-Motive Peaking Plants, contact your Electro-Motive representative.

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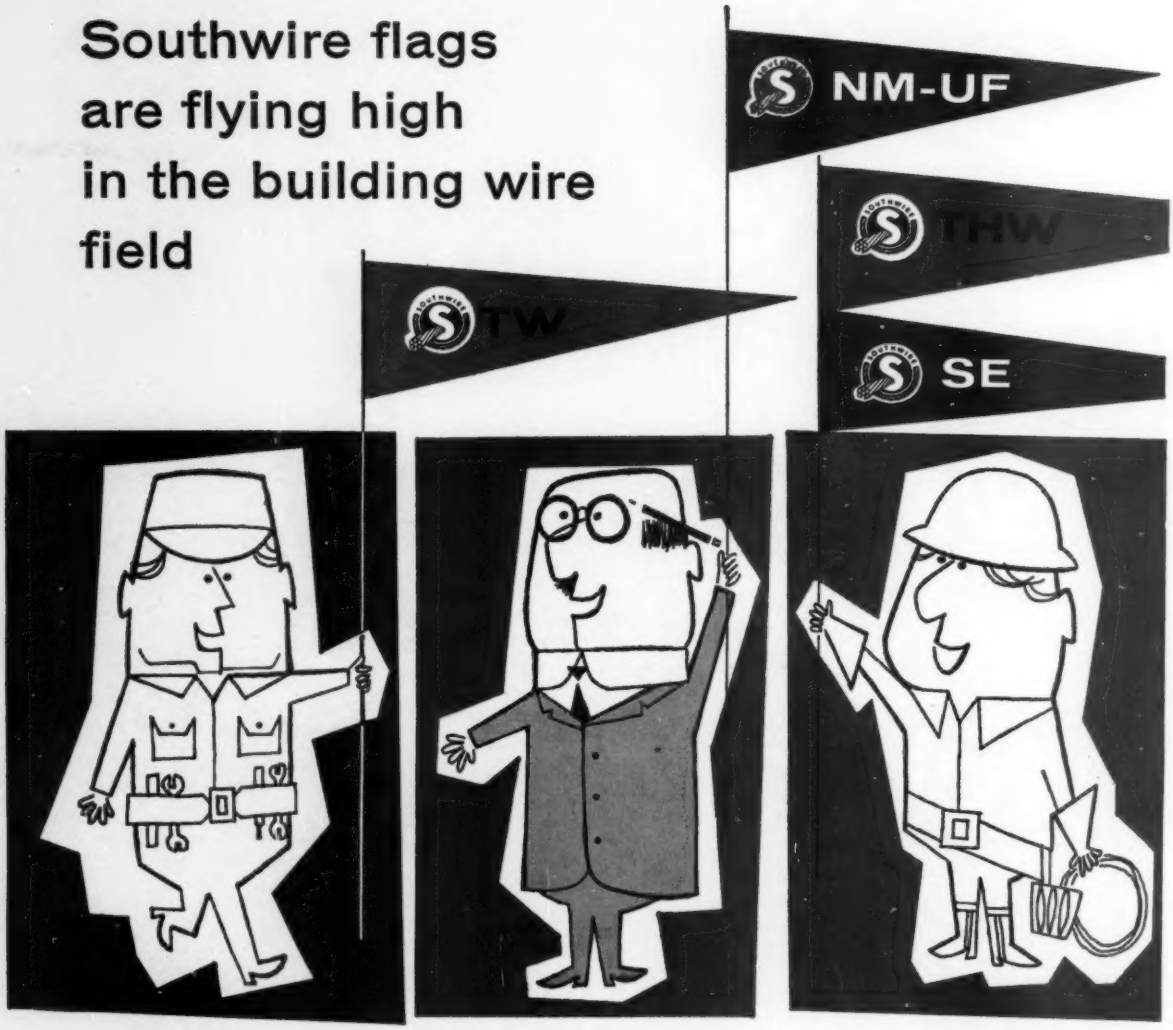
Southwire flags are flying high in the building wire field



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We've built new, compact coils for these money-savers. They're wound LV-HV-LV around one insulating cylinder, and locked into sections of great mechanical strength by corrugated oil ducts and thermosetting insulation. Short circuit tests using 50 times normal current (twice as much as the industry standard) didn't even faze them.

The HI-THERMAL-CAP element, which combines this improved coil with a wound core of cold-rolled oriented grain steel, has excellent electrical characteristics: low impedance for better voltage regulation; low core and copper loss for economical operation. The result: you get top efficiency *plus* high capability with these transformers.

HI-THERMAL-CAP Transformers are available in singlephase ratings of 167 kva and smaller, 15 KV and below, for direct pole mounting. You can get them from factory, branch or distributor stocks now. And you can get complete information from your Wagner Sales Engineer. Check with him, or write us.

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To this end, careful consideration of Moloney Electric Company's qualifications will reveal these facts:

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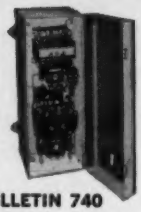
No matter what your reason for reduced voltage motor starting may be, Allen-Bradley has the *right* starter. Not only can the power company's requirements be satisfied exactly, but the A-B starter will at the same time provide the best possible starting conditions for the motor and the driven load. At least one of the starters described below will completely satisfy your operating requirements. For more detailed information, send for Publication 6088.

AUTOMATIC AUTOTRANSFORMER starter for squirrel cage motors that should not be started at full voltage. The autotransformer reduces line voltage during acceleration. Taps permit adjustment of voltage applied to the motor.

MANUAL STEPLESS RESISTANCE starter has graphite compression disc resistors for velvet smooth starting of squirrel cage motors. Starting of the motor is under the complete control of the operator.

BULLETIN 640



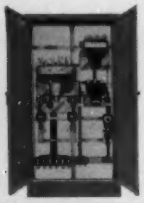
BULLETIN 740

AUTOMATIC RESISTANCE starter has graphite resistors automatically inserted in series with the squirrel cage motor at starting. Resistors can easily be adjusted to motor and load conditions, giving velvet smooth acceleration.

BULLETIN 646

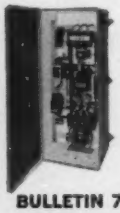
MANUAL AUTO-TRANSFORMER starter for use where load conditions or power company rules require reduced voltage starting. The air break starter shown has double break, silver alloy contacts.

AUTOMATIC MULTI-POINT RESISTANCE starter for use on network systems. Resistors inserted at starting are cut out in definite steps. Time intervals are readily adjustable to provide velvet smooth acceleration.



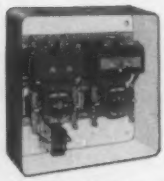
BULLETIN 741

AUTOMATIC STEPLESS RESISTANCE starter is not equalled for velvet smooth motor acceleration. It will satisfy any power company requirement. Eliminates lamp flicker on network systems used for both power and lighting.



BULLETIN 742

AUTOMATIC PART WINDING starter for use with squirrel cage motors having two separate parallel windings. Made in two-step type, and three-step type with resistance connected in the line on the first step.



BULLETIN 736

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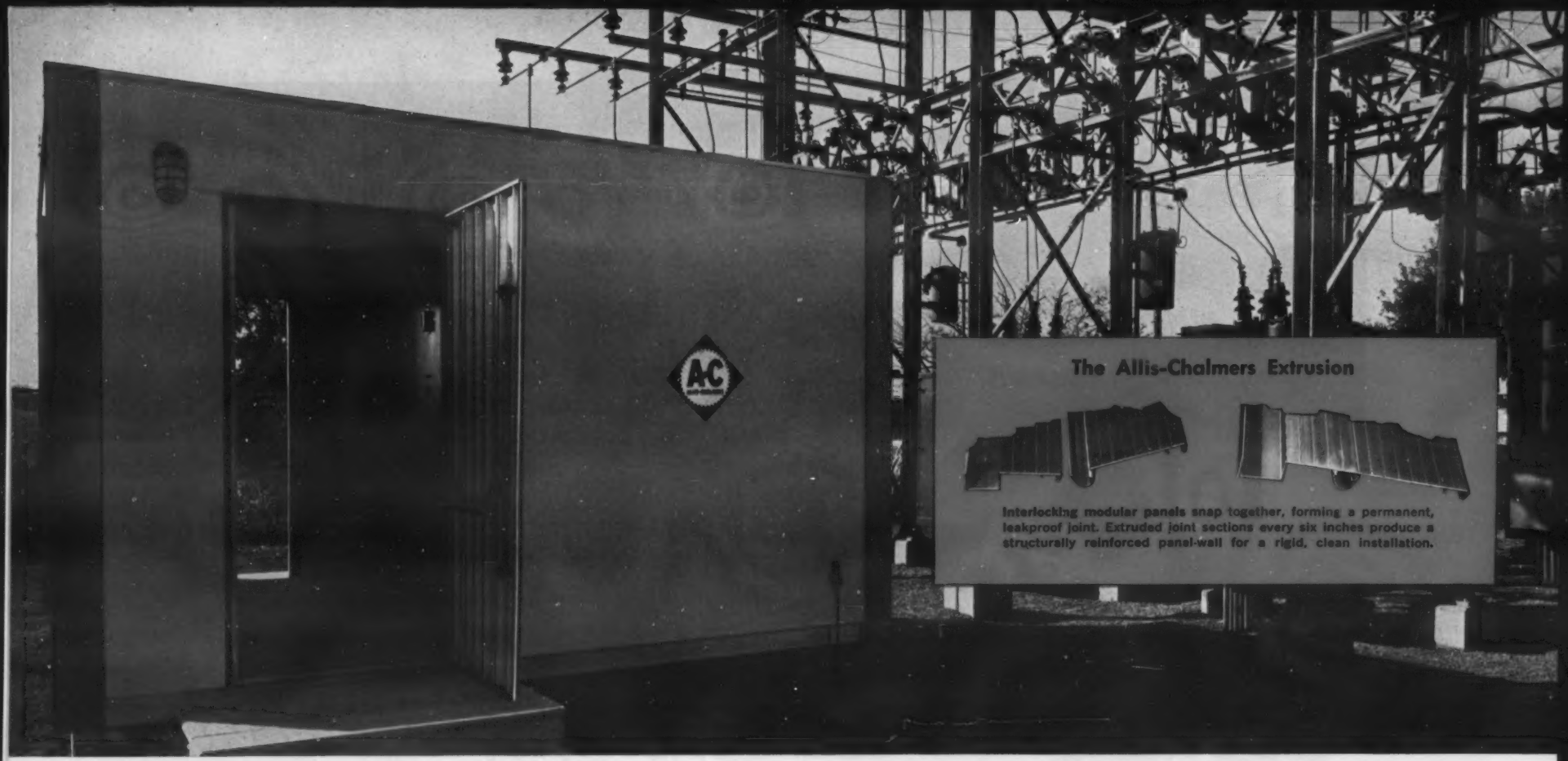
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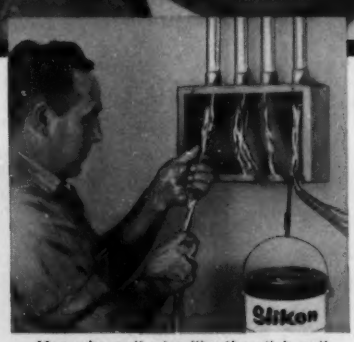

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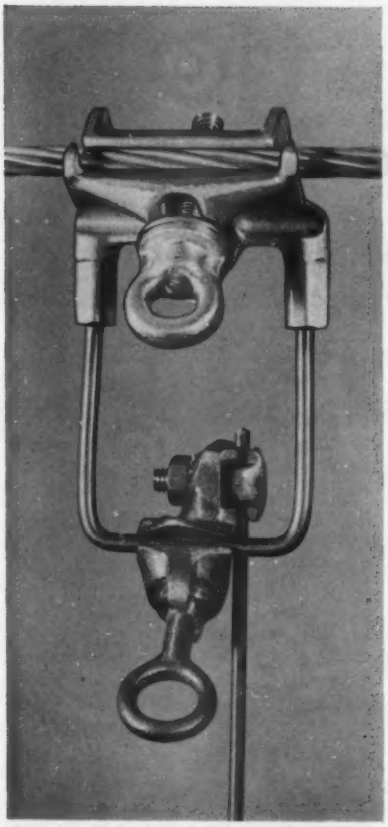

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New look at basic impulse levels

Further savings may be possible. This first of two articles examines the situation with respect to transmission lines

By H. H. Strozier, Assistant Chief Planning Engineer, Georgia Power Co., Atlanta, Ga.

◆ Dramatic savings to transformer users have resulted in the use of transformers with reduced basic impulse insulation levels.

Indications are that additional savings can be made through further reduction of transformer BIL's; also the possibility of insulation reduction throughout a system holds considerable promise.

Insulation standards have been in use since the beginning of our industry. While many of these standards were not accepted nationally, they were accepted in individual companies and individual engineering companies. On investigation, the reasons for many of these practices were found to be obscure; experience proved them to be adequate.

Accepted standard basic impulse insulation levels (BIL) were adopted by the Joint AIEE-EEI-NEMA Committee on Insulation Coordination in January, 1941. This work was the result of approximately ten years of study.

To arrive at their findings the committee considered insulation practices in common use, insulation strength of equipment (transformers and circuit breakers), lightning phenomenon, testing methods, performance of lightning arresters, other protective equipment, and experience. Prior to this study any attempt toward insulation coordination was by rule of thumb or individual ideas, in short, guesswork.

A practice which existed until 1941, and in some cases still today, was to increase the insulation level whenever a flashover occurred or equipment failure resulted. The standards set in 1941 resulted in definite insulation levels for the various voltage classes (Table I), standardized the impulse test wave (1½ by 40 us), and set forth the following definition:

"Basic impulse insulation levels are reference levels expressed in impulse crest voltage with a standard wave not longer than 1½ by 40 microsecond wave. Apparatus insulation as demonstrated by suitable tests shall be equal to or greater than the basic insulation level."

The present accepted standards were selected for 1941 model equipment. The BIL's were the same for all systems; no consideration was given as to whether the system was grounded or ungrounded. Approximately 20 years

Table I — Basic impulse insulation levels

Column 1	Column 2		Column 3
Reference class kv	Standard basic impulse level kv		Reduced insulation levels in use — kv (1941)
1.2	30*	45**	—
2.5	45*	60**	—
5.0	67*	75**	—
8.7	75*	95**	—
15.0	95*	110**	—
23.0	150		—
34.5	200		—
46.0	250		—
69.0	350		—
92.0	450		—
115.0	550		450
138.0	650		550
161.0	750		650
196.0	900		—
230.0	1,050		900
287.0	1,300		—
345.0	1,550		—

* Distribution equipment
** Power equipment

Table II — Line BIL's in use

Voltage class	BIL Minimum	BIL Average	BIL Maximum
69	430	700	1,070
115	585	1,100	1,600
138	700	1,250	1,600
161	850	1,250	1,625
230	1,150	1,400	1,800

of research, development, and experience have elapsed.

Transformer insulation has improved, and most important the lightning arrester has improved more in the last 20 years than the entire period prior to 1941. In view of the present art of protective equipment, it appears that the complete range of standard BIL's is in line for revision.

Need for reappraisal

The number one need is economics. Overinsulation with no apparent improvement in system reliability is wasteful.

Rapid load growth has demanded higher voltages across the board; distribution, subtransmission, and transmission. Following past practices, whenever the voltage goes higher than common practice, there is a tendency to overinsulate.

As can be seen in Table I for voltages up to 15 kv, one level is acceptable if the circuit is distribution, another if it is subtransmission. Could not a similar situation exist for subtransmission and transmission?

Also, what is the dividing voltage between distribution and subtransmission, and subtransmission and transmission? As a distribution voltage 34.5 kv is now in use, and circuits as high as 138 kv are in use as subtransmission circuits.

As subtransmission voltages go higher the space required for distribution substations must be larger, which in congested urban areas becomes prohibitively expensive. Any moves toward reducing equipment and bus insulation will result in more compact substations, and allow low voltage substations to be converted to higher voltage without additional real estate.

If line insulation can be reduced, better utilization of existing right-of-way can be made, or even allow existing lines to be operated at a higher voltage with a minimum of modification. It is becoming increasingly necessary to construct high voltage lines on city streets.

Many articles in trade magazines have described a number of designs for city street lines of 69 kv, 115 kv, and 138 kv; in practically every case an attempt has been made to design a line with the same BIL as a cross-country line of the same voltage. In a number of cases the line is reliable and has a good performance; however, it is unsightly and is subject to poor public relations.

It is possible that a line of

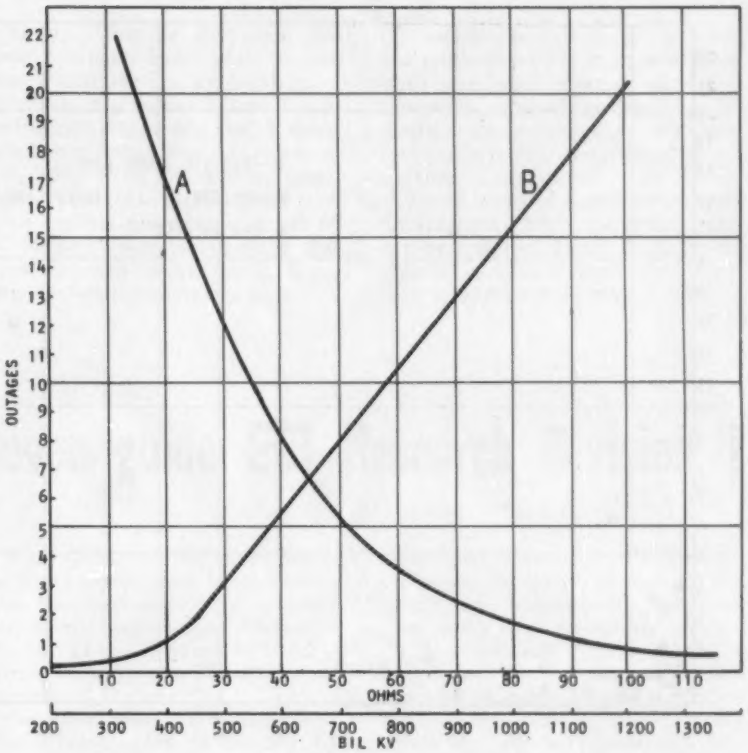

Fig. 1—Curve A shows outages per 100 miles per year versus BIL, and Curve B shows the outages per 100 miles per year versus ohms of footing resistance. These are typical curves and not for a specific line.

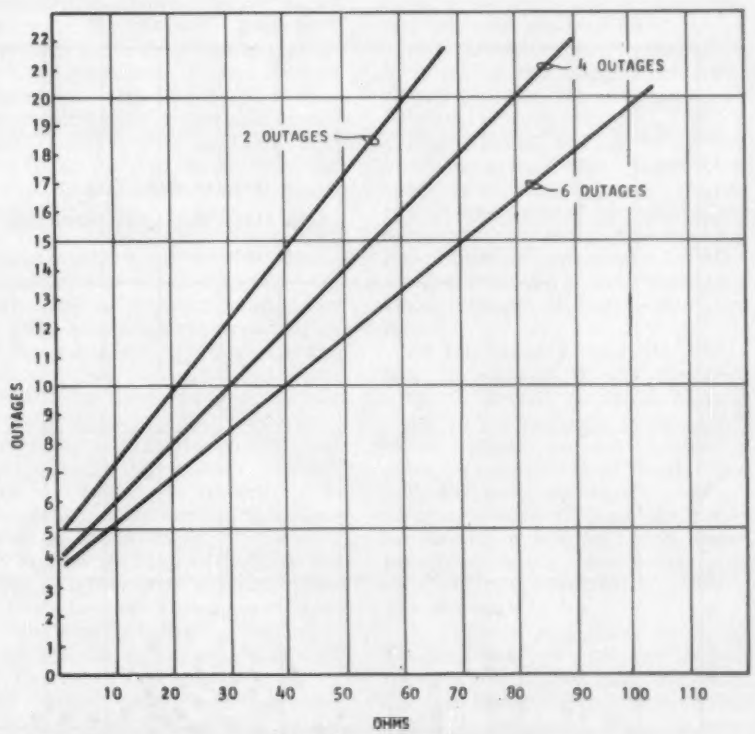

Fig. 2—This chart gives the relationship between BIL and tower footing resistances for probable outages per year per 100 miles of line.

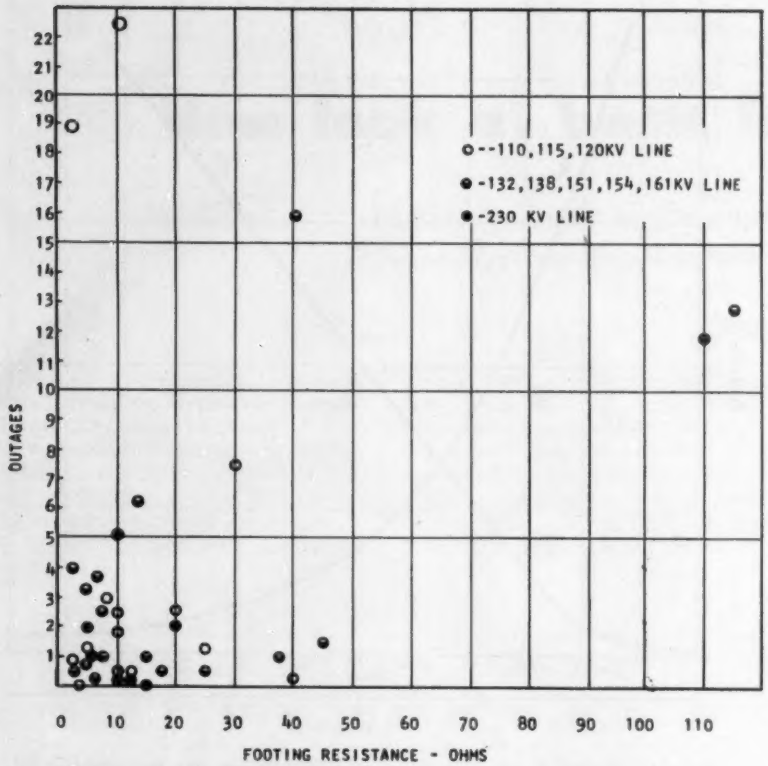

Fig. 3—Outages per 100 miles per year versus ohms footing resistance for lines of various kilovolt ratings.

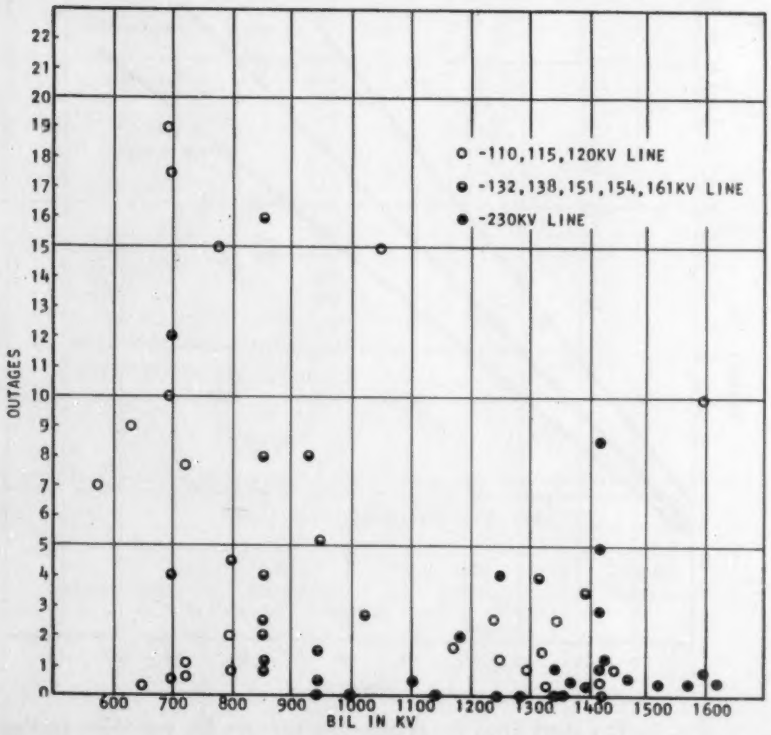

Fig. 4—Outages per 100 miles per year versus BIL.

slightly reduced BIL will be just as reliable, and present an improved appearance. One argument for the high BIL line is that the line competes with an underground cable, and regardless of cost is less expensive than the cable. However, if because of public sentiment high voltage lines are eliminated from city streets, then the underground cable is the only alternate.

It is not difficult to design a system which will operate satisfactorily if money is no object and a factor of safety of ten to 12 is used. A thorough look at insulation levels based on modern protective equipment will result in full utilization of modern equipment, and a more economical and reliable installation.

Transmission lines

There are practically as many transmission line designs as there are designers. The BIL ratings of these lines vary as much as 2.5 to 1 from the highest BIL to the lowest for lines of the same operating voltage. Table II shows practices now in use.

Volumes have been written on line theory and line design. It is not the intention of this paper to add to this multitude of data, but simply to review some of the most apparent points.

It is common knowledge that lightning is the chief factor in selecting line insulation. Four basic parameters determine the performance of a line: footing resistance, insulation level, midspan clearance, and span length.

Curve A in Figure 1 shows the relation between outage probability versus line insulation. It is apparent that at the lower insulation levels a small increase in insulation will result in a large decrease in outage probability.

Curve B in Figure 1 shows the relation between footage resistance versus outage probability. This is practically a straight line function for values of resistance down to 20 ohms, with the slope decreasing for values below 20 ohms. The degree to which low footing resistance can be met depends on local soil conditions.

The method used to reduce the equivalent footing resistance and the degree to which this is carried is a matter of economics, because the problem is one of balancing the cost of lowering the resistance against the cost of increased insulation. (The curves in Figure 1 are typical curves, not a specific line.)

The design of a line against lightning for a desired performance is practically independent of operating voltage. Insulation of approximately four times line to neutral crest voltage will prevent outage from switching surges.

The practice of designing a line for a given performance is practically universal. The entire design is based on probability, since there is no lightning-proof design available at present. Transmission lines require one level of performance, while a subtransmission line is acceptable with a lower level of performance. The voltage class of the line has no bearing; its purpose determines the performance.

The question now becomes, how many outages per year per 100 miles can be tolerated? A given line can have its outage rate reduced from four to two by increasing its BIL from 1,025 kv to 1,275 kv. The question then is, is the outage reduction worth the cost of increased insulation? If we assume momentary outage with successful relay and OCB operation, then the answer is negative.

With modern relays and high speed circuit breakers, outages caused by lightning should be of a momentary nature. There is little chance of burndowns with the size conductor in use today. With wood pole lines, experience indicates that the ratio of power follow to flashover ranges from 0.35 to 0.50, for steel pole lines from 0.50 to 0.85.

Assume the line is designed for a given probability of outage, multiply this by the probability of incorrect breaker and relay operation, and the ratio of power follow to flashover, and in most instances a modern line has a very small probability of permanent outage due to lightning.

Returning to the parameter, footing resistance, Figure 2 gives the relation between BIL and tower footing resistances for the same number of probable outages per year per 100 miles of line. Below 100 ohms this is practically a straight line function. For city street lines it is easily possible to obtain a footing resistance of less than five ohms or even less than one ohm due to proximity of pipes and the distribution neutral.

It is reasonable to assume that a city street line of lower BIL will perform as well as a cross-country line of considerably higher BIL. As more experience is gained on high voltage city street lines, it will be possible to test this assumption. Due to the need for more compact lines, this is one area which invites exploration.

Curves in Figures 1 and 2 are theoretical; Figures 3 and 4 show actual performance of a number of 115-, 138-, 161-, and 230-kv lines. These points have been weighted to an annual isokeraunic level of 75. It is not possible to draw any curve through these points; however, two conclusions are possible: (1) except in two to three cases, the performance is in general good with overhead ground wire and moderate ground resistance; (2) similar performance is obtained for a given BIL regardless of operating voltage.

Three types of construction used on Georgia Power Company lines are as follows: 44-kv single wood pole with pin or post type insu-

(Continued on page 110)

Seven guide EEI Research Division

◆ A committee of seven leading electric company chief executives has been appointed to guide the newly established Research Division of the Edison Electric Institute, according to EEI President Sherman R. Knapp.

The new research division executive committee is headed by Willis Gale, chairman of Commonwealth Edison Co., as chairman. Members are P. A. Fleger, chairman of the board and president, Duquesne Light Co.; R. A. Gibson, president, Hartford Electric Light Co.; J. K. Horton, president, Southern California Edison Co.; D. C. Luce, president, Public Service Electric and Gas Co.; W. W. Lynch, chairman of the board and president, Texas Power & Light Co.; and W. O. Turner, chairman of the board, Louisiana Power & Light Co.

"With leadership of the caliber represented by the new division's executive committee and with the high level of support being given to EEI's expanded research activity by companies throughout the country, we expect important progress to be made in a number of fields of industrywide interest," Mr. Knapp said. He pointed out that already 120 electric companies are voluntary subscribers to the research program being undertaken by the institute.

The new division will utilize the institute's research projects committee, formed nine years ago, which recently made recommendations leading to the establishment of the new Research Div.

A recent survey by the committee showed that more than 1,000 research projects of EEI and its member companies were in progress or had recently been completed. These activities included work in many phases of the generation, transmission, distribution, and use of electricity.

"Research has always played a major role in the advance of the electric industry, and the opportunities for fruitful research efforts continue to increase," Mr. Knapp said. "This growth in research opportunity is being recognized by the establishment of EEI's research activity as a major division of the institute, comparable to the sales, engineering, and other divisions of EEI."

Mr. Knapp made it clear that in selecting and administering research projects, the institute's expanded activity would involve projects suited to action by the industry as a whole. "There are many research projects which are better undertaken by individual companies—whether manufacturers or utilities—and there are others better suited to joint action by small groups of companies," he said.

At the present time, the institute is engaged in 23 research projects. Recent activities include research on methods of applying heart massage, extra-high-voltage cable, water pollution, heat storage, galloping conductors, aluminum conductor fittings, electronic accounting machines, high temperature steam generation, and effect of temperatures on properties of metals.

A study is also being made of developments in various power sources which may have potential for the future. These include the fuel cell, thermionic tube, thermoelectric generator, and devices making use of the principle of magnetohydrodynamics.

Application of lightning arresters

Second of two articles discussing the application of arresters to stations and substations to prevent interruption of service

By H. C. Stoelting, Development Engineer, Line Material Industries, Milwaukee, Wis.

◆ An important factor to be considered is the probability of occurrence of a given magnitude of current in a lightning stroke. The frequency of storms at a given area enters into this probability.

Several thousand records of discharges through lightning arresters have been obtained. Note that the probability curves in Figure 1, for arresters located in stations which are shielded against direct strokes and which have circuits shielded against strokes for a distance of at least one mile from the station, are substantially different from the number of strokes to distribution circuits, unshielded transmission circuits, and other tall structures.

The probability curves, particularly for distribution circuits, also differ for lines located in urban and suburban areas as compared to lines in rural areas.

Probability curves such as shown must be converted into the number of strokes per arrester per year, which in turn is dependent upon the storm frequency in the area.

The discharge voltages of lightning arresters are published on the basis of ten- by 20-microsecond current waves. This type of wave is not representative of the majority of strokes in the field. Lightning strokes generally have a higher rate of current rise than test current waves. The total number of reliable records of the wave shape of currents discharged through arresters in service is less than 100, so that reliable probability records cannot be obtained.

An interesting observation is that the highest rate of current rise obtained in the discharge through an arrester was 5,000 amperes per microsecond. This record was obtained on an unshielded, wood pole, transmission line.

The effect of high rates of current rise is to increase the discharge voltage of the arrester as shown in Figure 2. Note that the increase occurs very close to the start of the wave. This rate of rise occurs during the time when the insulation strength of equipment is higher than the BIL.

Since very little is known about the wave shape of currents through lightning arresters resulting from lightning strokes, taking this factor into account in arrester application is not possible. Thus, the effect of steep wave fronts are included in the margin of safety between the BIL of equipment and the discharge voltage of arresters.

After the arrester voltage rating, the discharge current, and the discharge voltage have been selected, it is possible to select the type of arrester that will provide the required protection. A choice of distribution, intermediate, and station-class arresters is available for circuits that require standard arrester ratings up to 20 kv. In addition, distribution arresters with ratings up to 30 kv are manufactured.

In the range of arrester ratings between three and 121 kv either intermediate- or station-class arresters can be chosen. Above 121 kv only station-class arresters are available.

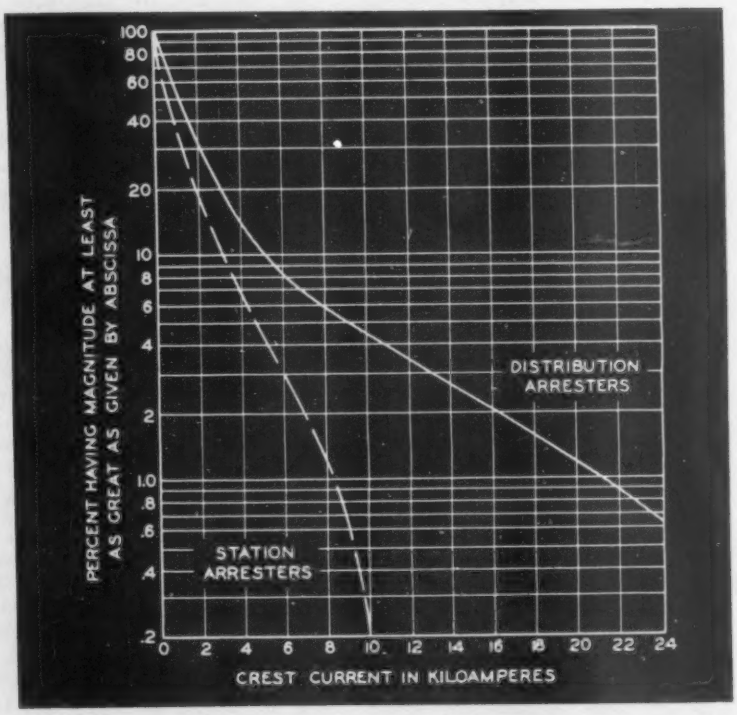

Fig. 1—This chart shows the percentage distribution curves of discharge current in station and distribution lightning arresters.

The discharge voltage for a given arrester rating at a given current is increasingly higher for station-, intermediate-, and distribution-class arresters. Thus, the intermediate-class arrester gives better protection than the distribution arrester; and the station arrester gives better protection than the intermediate class. Differences in the protective levels of the several classes of arresters are illustrated in the accompanying table. Maximum industry values for 15-kv ratings are used to exemplify the differences.

Industry values for arrester protective characteristics can be obtained from the reports published in *AIEE Transactions*. The latest values are generally available from the NEMA lightning arrester standards or can be obtained from the AIEE protective devices committee. The reports list the maximum values for the industry and also the average values of the industry averages. Another source of information is the protective characteristics listed in manufacturers' bulletins. These, undoubtedly, give the latest information.

When the application study is finished and no arrester is available to meet the proposed protection levels, then most likely some assumption was made in the preceding steps that was not correct. If this happens, an examination is necessary of the basic impulse insulation levels, the margin be-

(Continued on page 109)

Arrester Class	Wave Front Impulse Sparkover – Kv	Discharge Voltage – Kv		
		5000 Amperes	10000 Amperes	20000 Amperes
Distribution	88	69	77	88
Intermediate	60	46	51	60
Station	55	41	45	50

Table I—Arrester characteristic

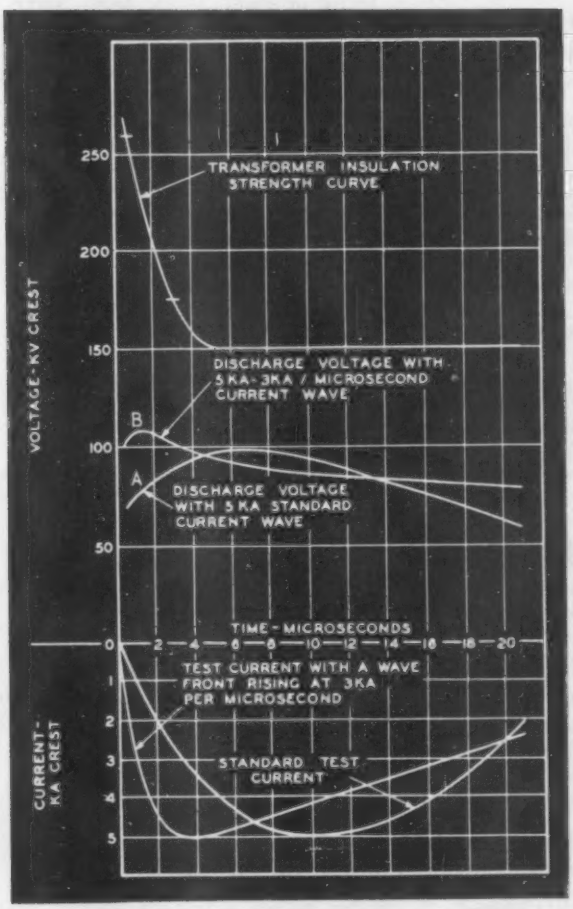

Fig. 2—The effect of rate-of-rise of surge current discharged by arresters on the arrester discharge voltages.

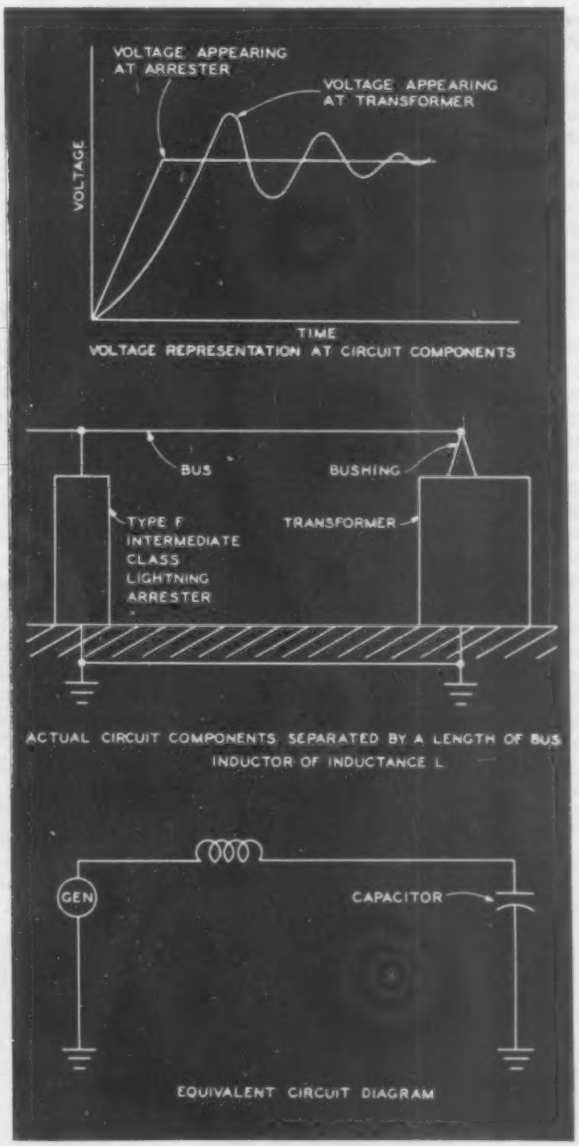

Fig. 3—These diagrams show the concept of overvoltage when the voltage located at equipment which is situated at a distance from an arrester rises above the voltage level which is maintained by the arrester.

Safe on-the-job driving gets boost

With increasing emphasis being given by utilities to on-the-job safety, the importance of safe on-the-job driving is receiving special attention

By J. F. Belcher, Jr., Safety Director, Nashville Electric Service, Power Board, Nashville, Tenn.

◆ The common fault in automobile collisions today is not unsafe acts and unsafe conditions of themselves.

Rather it is unsafe acts and unsafe conditions abetted by a negative attitude on the part of the driving public—an attitude that brazenly proclaims, "It's wrong when you do it, but I'll get away with it if I can!"

Basically, there's nothing wrong with our traffic laws that an aroused public determined to prevent mass suicide can't amend or improve to make them fully effective.

If you were to ask the average man ten elementary questions about last year's World Series, he would probably have nine of the ten answers for you immediately. But, if you were to ask him ten elementary questions about the traffic laws in his city or state, the chance of his batting 300 would be poor indeed. Do *you* know your traffic laws? Do *you* take your car or company vehicle out on the highway, honestly believing that you will abide by the traffic laws when it is a proven fact that we don't *know* them?

How many of us would sit in on a bridge game if you had no knowledge of how it was played? You wouldn't. But countless individuals who consider themselves intelligent think nothing of stepping into a vehicle to drive when they haven't the slightest idea of the laws governing traffic. Now the fellow in the bridge game can do no more harm than trump his partner's ace; but the driver of a vehicle can easily kill himself and others, too, to say nothing of the property damage which he may cause.

The human desire for self-preservation makes each individual willing to conform to accepted rules of safety with respect to his living or work activities. If he were able to combine a thorough knowledge of road rules with an attitude of courtesy for other drivers, one of our most serious accident obstacles would be overcome. How you drive, where you park, your attitude towards pedestrians and other drivers as you go about your daily activities, these are all issues with which we, as drivers, should be concerned.

Be a defensive driver

First, it is smart to be a defensive driver; for as such you never overestimate the other fellow's skill or knowledge of safe driving procedure by driving in anticipation of mistakes the other fellow may make, and your own accidents can be almost wholly avoided. This is especially true when related to your own speed, especially on approaches to intersections.

What is your attitude at an intersection in the city, on a state highway, or at a country road crossing? The approach should always be the same. Slow down sufficiently as you approach an intersection, a driveway, or other potential danger spots, so that you may make a quick emergency stop if another driver should do the unexpected by violating the law or common sense rules of safe driving.

It is foolish to take a chance at any intersection, busy or dull, insofar as traffic is concerned. Your approach to an intersection should never be made with the cocksure attitude that *you* have the right-of-way but instead the thought "I'll just slow down and give the other fellow a chance." That's simple courtesy.

The law, of course, says that the driver on the left shall yield the right-of-way to the driver on the right. Remember, nearly 100 persons died in automobile collisions last year because they had, or thought they had, the right-of-way. Adjust your speed to suit good road manners and your accidents will be rare.

A good driver allows himself an adequate margin of safety whether driving his company's car or his own private automobile. He follows at a reasonable distance behind other cars when road conditions are unfavorable. On unfamiliar roads, in rainy weather, when he knows that he is under par physically or mentally, or when there are pedestrians, he proceeds with greatest caution. You who are professional drivers should create within yourself a feeling of pride in being responsive to these phases of safe motor vehicle operation.

Out on the open road many people like to feel a sense of power that they themselves do not personally possess. To them a modern high-power automobile is a source of thrill, an escape, a substitution of motive power, for power of mind, power of body, or power of will. So with 1961 automotive power in their hands, they become the deadliest menace of our highways. No matter how well they may be acquainted with our traffic laws, or how keen their response behind the wheel, it is a deplorable fact that they have not been schooled properly in their attitude towards driving. They have not learned the basic lesson of *control* over the power that destroys.

According to the American Automobile Association, the reaction time of an alert motorist is three-fourths of a second. Incredible as it may seem, that is a fact. Thus when you are driving at 60 mph, you will use 66 precious feet in an emergency before your foot even touches the brake pedal. That is about four car lengths.

Let's suppose that you are making a routine trip through a suburban area which is not densely populated. Your speed is 50 to 60

mph and a child darts, from behind a parked car some 50 or 60 feet in front of you, into your path. Can you stop? Yes, but you can not stop in time to keep from striking that youngster. What caused the accident? Speed.

Too frequently in routine driving over well known highways we are prone to let our foot rest heavily on the accelerator. Too often we think about our business problems instead of the business of driving.

You should remember the fellow behind you. He is not psychic. He cannot read your mind or anticipate your movements. The only method of communication you have with him is by the directional turn signals on your truck or car and by your hand signals. You should know these hand signals. It is your duty as a driver to give them correctly and precisely, to use your directional signals, and to see that these signals are working at all times.

All accidents do not occur while vehicles are being driven. Improperly parked vehicles can be as hazardous to safety as moving ones.

Do you know the state law for parking, stopping, or standing outside the city limits, as well as within? Thirty persons lost their lives last year because they were not so acquainted or because they did not exercise ordinary common sense in parking their automobiles.

Do you insist that your brakes be kept in good working order? Do you remember to set the hand brake and stop the motor before leaving your parked vehicle?

If you are subject to calls at night on jobs, is your car or truck properly equipped with reflectors and stop lights? Are those reflectors of such size and characteristics and so maintained as to be readily visible at night from a distance of 500 feet? Are your rear reflectors red? Check your vehicle, and if these requirements are not in accordance with the rules of your state, consult your police. Your safety is his work.

As a driver, you should be familiar with the various road signs and their significance. Road signs are truly "signs of life." As a driver you should know and become familiar with their basic shapes and meanings. These signs were designed to make highway travel safe.

Traffic problems are as old as man's urge to travel. They were born in prehistoric times when our caveman first roamed the earth and threw together a pile of stones for a trail marker. Traffic problems became more frequent after man developed the wheel and increased his travels. And as travel increased, so travelers would become lost and fall victims to all kinds of hazards of the road.

Ancient Rome had her traffic problems, too, due to the great number of chariots on narrow streets made principally for pedestrians. The Caesars finally

(Continued on page 108)

Effectively used A-Bug campaign can help to reduce accident rate

By J. F. Belcher, Jr., Safety Director, Nashville Electric Service, Power Board, Nashville, Tenn.

◆ Discussing safety and getting ideas from the general manager proves very profitable.

Every so often a safety program needs a shot in the arm and that shot could and should come from your general manager's office. Just a short time ago while discussing our safety program with the general manager, he brought forth the idea of the "A-Bug." After much thought and planning, the "A-Bug" was created.

First, how was the "A-Bug" going to be introduced to the employees? Each supervisor was informed of our plan. Posters would be placed on bulletin boards for five weeks before anyone met the "A-Bug." Each employee asking what was the "A-Bug" would be told to see his foreman or supervisor, who would tell him to watch the bulletin board for more information.

Second, the posters would be placed on bulletin boards after hours, so no one would see you place them. Have an artist or sign painter paint your signs in bright colors.

Third, start placing your posters on boards as follows:

First poster—The "A-Bug" will get you if you don't watch out.

Second poster—More dreaded than the black widow spider — The "A-Bug."

Third poster—He travels along and he's a killer—The "A-Bug."

Fourth poster—When he can't kill he maims—The "A-Bug."

Fifth poster—Here is the "A-Bug." (Have his picture) Note: "A" is for accident.

Now that you have introduced the "A-Bug" to everyone, keep the safety meetings going regularly, and be sure everyone attends a safety meeting each month. If you have an employee injured, send him a post card with a picture of the "A-Bug" on it, and let it read as follows:

Very sorry you were bitten by the "A-Bug," Hope you recover real soon.

Your Safety Department

You are then doing two things, letting them know that you care for their safety on and off the job and promoting good employee relations with the company. We were in this program during a real blizzard and were pleased to have worked 85,000 man hours straight without a single accident. Our accident rate started to drop and is below the national average, also our vehicle accident rate is below the national average.

We then went to the advertising department, which was interested in our safety program, and with their assistance much was gained. However, without management's support no safety program can accomplish anything.

OPERATING SINCE 1946 without attention—F-P Series 61300 Control near the State House, Providence, R. I.

New England Electric Made Lighting History With First Use of F-P Controls

The first large-scale user of the original Fisher-Pierce photocontrol was the utility that provided the power we used in manufacturing it — New England Electric System. After as long as 14 years of completely maintenance-free operation, many of these Series 61300 units are still giving useful service. They've been useful to us, too, providing experience for development of later tube-type controls — and the present Series 6600A tubeless controls.

Even before the new 6600A Series was released for general sale, progressive New England Electric was using strange looking F-P tubeless controls in Quincy, Mass., on an experimental basis. Many of these specially built "experimental" controls, installed in 1956, are *still* operating Quincy's mercury vapor lamps — also an innovation at that time. Now firmly established, multiple individual control — with no separate high voltage street-lighting line — has served to reduce outage headaches from fierce New England storms. Overcoming all of the disadvantages of time switching, Fisher-Pierce controls answer the need for a low cost control that provides years of trouble-free service.

FIRST F-P TUBELESS CONTROLS—still operating—were installed by Quincy Electric Co. in 1956. Special lights and experimental controls enabled trouble-shooters to pinpoint cause of any outages in these new installations; mercury vapor lamps were also an innovation at the time.

HISTORIC QUINCY, MASS. (top right), home of John Adams and John Quincy Adams. Both presidents are buried in the United First Parish Church, shown here.

AT WORCESTER COUNTY ELECTRIC CO., the F-P Series 6100 Calibrator (right) is being used for setting foot-candle current values. As the operator gradually varies the light intensity, a front panel light indicates control operation and a foot-candle meter shows the operate value. Short-time delay in F-P controls permits foot-candle checking here and in the field.

NEW SERIES 6700 CONTROLS (bottom right) installed on 240-volt lines by Narragansett Electric Co. in Providence, R. I. These controls use the basic 6700A circuit, as described for 240-volt operation.

STILL MAKING HISTORY, New England Electric participated in building one of the nation's first atomic electric plants. The 136,000-kilowatt Yankee Atomic Electric plant at Rowe, Mass., is now in operation.

For complete design information and operating specifications on Series 6600A and 6700 controls, and the Series 6100 Calibrator, write The Fisher-Pierce Co., 59 Pearl Street, South Braintree 85, Massachusetts.

FP

FISHER PIERCE

Electrical and Electronic Equipment for Industry, Utilities and the Home

AN AFFILIATE OF SIGMA INSTRUMENTS, INC.

Economics of loading transformers

The way in which a utility loads its distribution transformers can have an important effect on total system operating costs

By Jules Silverstein, Distribution Transformer Dept., General Electric Co., Pittsfield, Mass.

◆ The way a utility loads distribution transformers can have a very important effect on total system operating costs.

These little "cans" come in such small kva packages and are bought is such great numbers—relative to, say, a turbine or power transformer—that many electric utilities have, to a large extent, ignored the effect which they can have on over-all system economics.

Of late, however, utilities are beginning to become more aware of the economic significance of this "can" on the pole. With the amazing growth of residential loads which we have witnessed during the past two decades and with reliable indications that this tremendous growth will continue, the distribution transformer will play an even greater economic role in the utility system of tomorrow.

In the ten years from 1948 to 1958, for instance, the rural and residential kwhr sales (that portion of the system on which pole-type distribution transformers are applied) jumped from 24 per cent of the utilities' total kwhr sales to 30 per cent of the utilities' total kwhr sales, as shown in Fig. 1.

Measured another way, during sales in the nation have grown at the past ten years the total kwhr an average annual rate of 9 per cent whereas the rural and residential kwhr sales have grown at a rate of 11.5 per cent.

This means that the poly-type distribution transformer—which is the means of voltage conversion in rural and residential areas—has carried an increasingly larger share of the total energy sales.

Forecasts for the future indicate a continuance of this trend. Between now and 1970, for instance, it has been predicted that the nation's total kwhr sales will increase almost 1-½ *trillion* kwhrs.[1]

The total energy consumption is forecast to grow at an annual rate of about 8.2 per cent, while the rural and residential portion of that total grows at a rate of 9.2 per cent. Also, by 1970 the rural

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[1]**For list of references see end of article.**

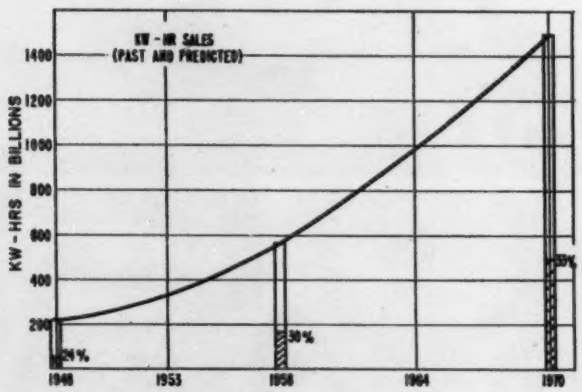


Fig. 1—Rural, residential sales rise in ten years.

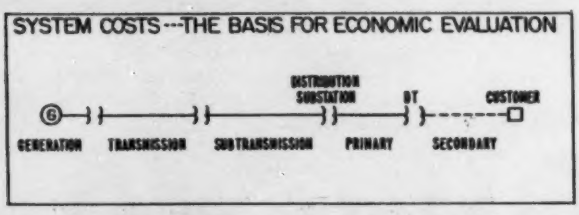


Fig. 2—Simplified diagram of an electric power system.

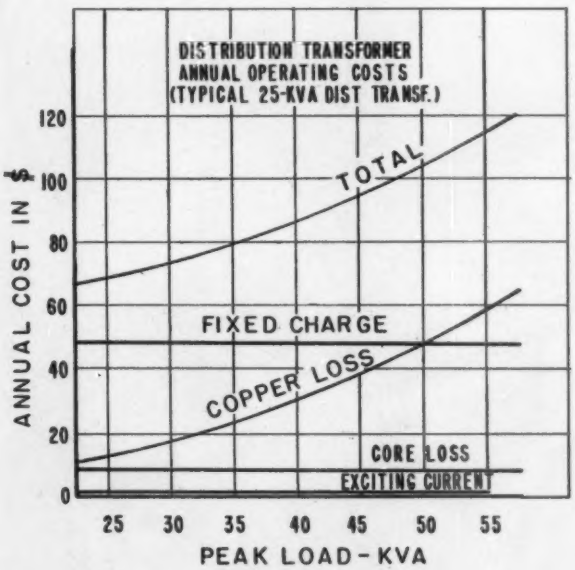


Fig. 3—The annual operating costs of a transformer vary with the load on the transformer. The effect of exciting current on total operating costs can practically be ignored. The top curve shows the total annual operating costs for different annual peak loads.

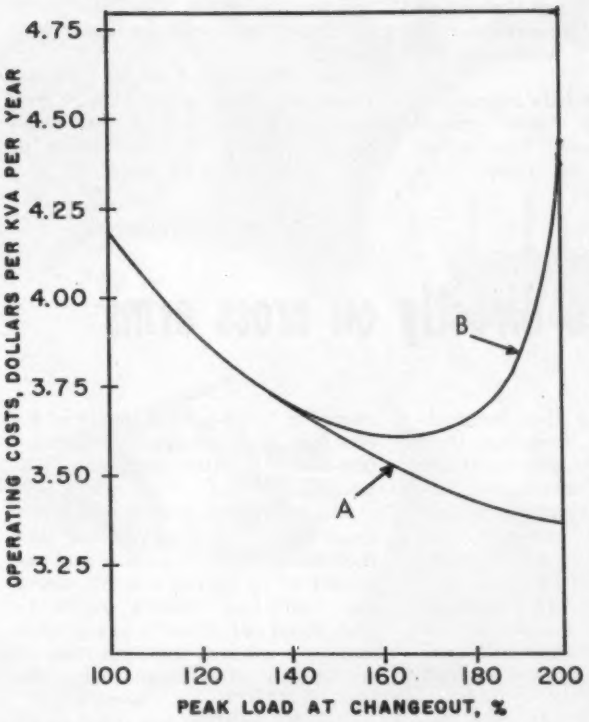


Fig. 4—Peak load at changeout vs operating costs. Curve B indicates what happens to costs when transformer life is considered in formulating loading policy for distribution transformers.

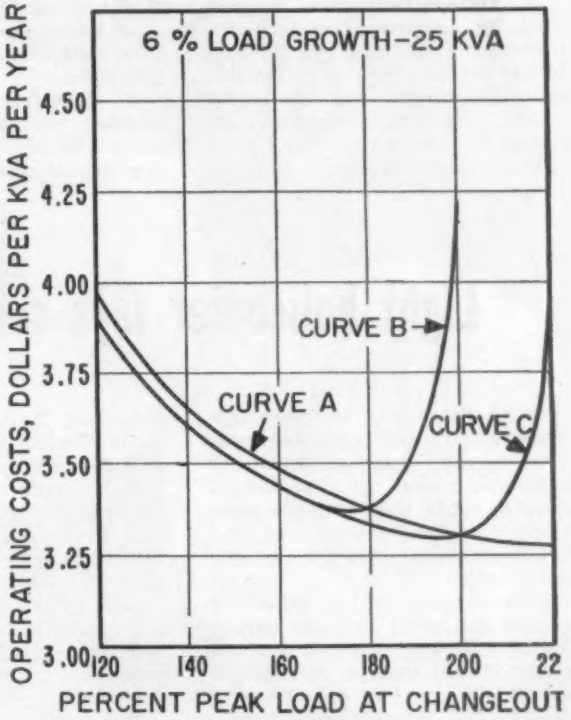


Fig. 5—Curve A and B have same significance in this chart as in Fig. 4. However, curve C shows how the new insulation systems affect costs when transformer life is considered in loading policy.

and residential kwhr sales will represent almost 33 per cent of the nation's total usage.

This rapid growth of rural and residential loads places the pole-type transformer in an increasingly important position on the utility system. The cost of operating these transformers should be an important consideration in establishing plans for future system practices.

To determine an economic loading policy for distribution transformers, one must first set up a method for calculating the operating costs of the transformer. After this is done, one set of loading conditions may be compared with another to arrive at the minimum-cost loading plan.

Fig. 2 shows a simplified one-line diagram of a power system and will serve to illustrate the basis of all calculations done to determine transformer operating costs and, ultimately, economic loading.

These costs consist basically of two things. The first is the investment in system equipment necessary to generate and transmit energy to the transformer which it consumes as core loss and copper loss. In other words, it is the amount of extra generator capacity that is needed to generate this energy, and the extra power transformer, transmission line, and substation capacity needed to carry this energy from the generator to the primary terminals of the distribution transformer.

The second part of the cost is the actual cost of fuel and labor expended to generate this energy every year.

Thus, the basic philosophy behind the evaluation of transformer losses is simply these two factors: the investment in system equipment needed to generate and carry this energy to the distribution transformer, and the actual cost of generation itself—that is, fuel and labor.

The actual calculation of these costs involves assigning values to certain system parameters and performing the necessary mathematics. Without going into the detail of what these parameters are, we will just define those components of the total operating costs which should be determined for each distribution transformer:

(1) **Fixed Charge**—The annual "write-off" of the transformer, including such items as return on investment, depreciation, insurance, etc.

(2) **Core Loss** — Transformer core loss is energy which is consumed 24 hours a day, regardless of the load on the transformer, so long as it is energized. This loss costs the utility money, for equipment must be bought to generate this energy and to carry it from the generating station to the primary terminals of the distribution transformer. It also costs money in terms of the fuel and labor.

(3) **Copper Loss** also costs money, again because of the utility's investment in system equipment and because of the cost of coal and labor needed to generate this energy. This cost varies with transformer loading.

(4) **Exciting Current** represents reactive kva which must be furnished to the transformer to magnetize its core. It can be expressed conservatively as the investment cost of primary shunt capacitors which would provide the necessary reactive exciting current.

(5) **Voltage Regulation** is measured by a voltage drop in the transformer. Since it results in a loss of revenue for the utility, this characteristic also costs the utility money. We would suggest computing this cost by calculating the annual "lost revenue," and deducting from this value the system costs which would be necessary if this "lost energy" were actually furnished.

(6) **Transformer Life** represents another economic factor which should be considered. The higher the transformer is loaded, the greater loss of life. The importance of this factor will be illustrated later.

Fig. 3 shows how the annual operating costs of a transformer vary with the load on the transformer, using the first four of

(Continued on page 78)

Light helicopter lays cable directly on cross arms

◆ Another first in powerline construction by helicopter was made recently when a light utility helicopter picked up a 900-pound spool of cable, flew over the poles along the right-of-way, and laid 3/4-inch cable directly on the cross bars.

Previous practice had called for a light helicopter to place only a light pull or lead line on cross bars mounted with pulleys, leaving the actual placement of heavier conductors to crews with truck-mounted spools and winches.

The job, which was performed for Sordoni Construction Co., Kingston, Pa., for the Pennsylvania Electric Co., took less than nine minutes by the 305-hp Hiller 12E helicopter. Construction officials at the project site estimated that it would have taken ground crews a full day to string the same 3,000-foot stretch of right-of-way.

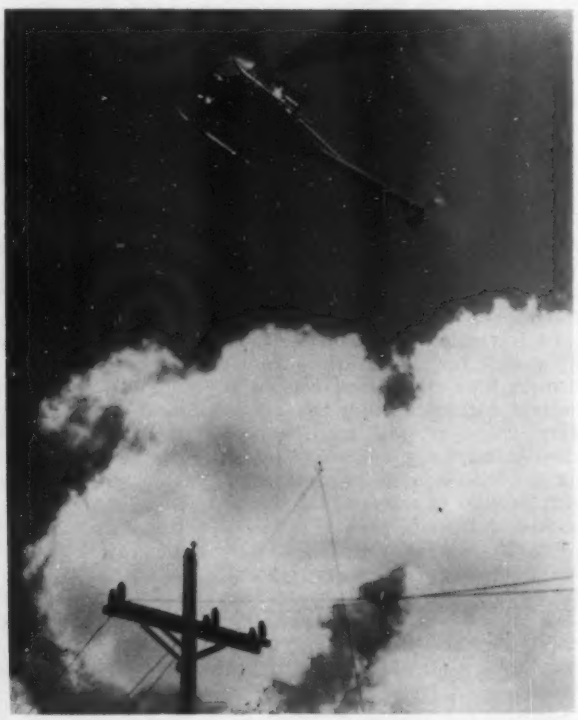
Additionally, the direct application by helicopter eliminates the time consuming installation and removal of pulleys needed for lead line techniques.

The project took place in the high (3,000-foot) hill country of northeastern Pennsylvania. The 3/4-inch aluminum cable, which comes in 1,900-pound spools of 6,000 feet, was rewound on two 3,000-foot spindles weighing 900 pounds.

The pilot purposely missed one cross arm during the placing and then hooked onto the cable and replaced it to adjust sag all along the 3,000-foot stretch right-of-way. Final adjustments in sag were made by ground and line men at the time of attachment to insulators.

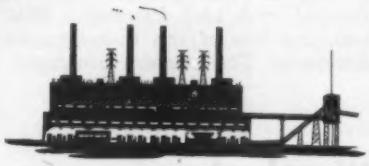
The Hiller 12E has also been used to place power poles and to haul all the materials to erect microwave stations on mountains.

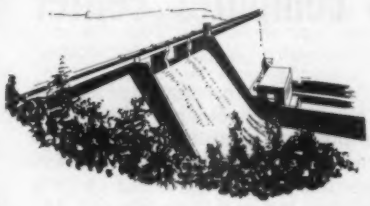
The helicopter is lifting a 900-pound spool of cable to place 3/4-inch conductor on poles along the right-of-way. The unique job was performed in Pennsylvania.

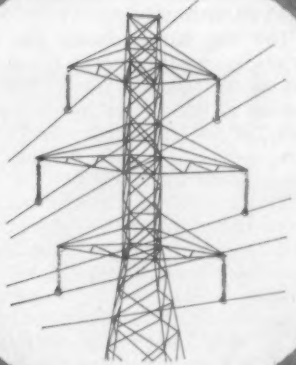


The helicopter pilot purposely missed one crossarm and then hooked onto the cable and replaced it to adjust sag all along the 3,000-foot stretch of right-of-way.

SHORTEST DISTANCE



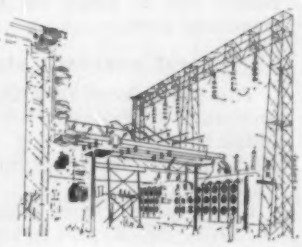


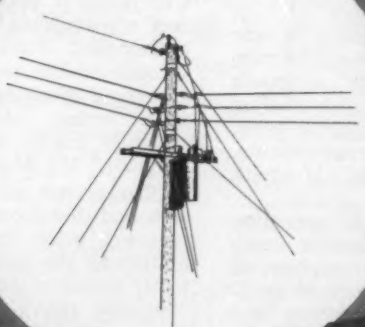


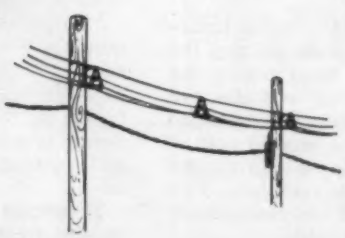
TO QUALITY AND SUPERIOR SERVICE

A SOUTHERN ELECTRICAL LINE

From generation — with transmission lines and distribution lines — to the service centers, SOUTHERN ELECTRICAL furnishes the finest of conductors to serve the electrical utility industry.







OLIN CONDUCTORS

METALS DIVISION Olin P. O. Box 999 • Chattanooga, Tenn.

the items just discussed. The fifth component—voltage regulation—is a controversial factor and, for the purposes of this analysis, is omitted. The sixth component—transformer life—will be discussed later. The particular curves are for a 25-kva transformer.

Note the relative cost of exciting current, core loss, copper loss, and fixed charge. As these curves show, we can almost ignore the effect of exciting current on the total operating costs.

The top curve shows the total annual operating costs for different annual peak loads. For instance, if the annual peak load on this 25-kva transformer is 40 kva, the operating costs during that year would be about $85.

This curve, which does not consider transformer life, says that a 25-kva transformer can be loaded to a peak load of, say, 55 kva and would yield annual operating costs of about $115—presumably at no sacrifice in life. This is not true, of course, because the greater the overload on a transformer, the greater the loss of life.

What we need is some way of injecting this life factor into the evaluation, so that any loading policy can be based on the true economic picture.

Recent economic study

This was done recently in an economic study reported to the industry last summer.[2] In this study, a computer program was set up as follows:

Given transformers rated 10, 15, 25, 37-½, 50, 75, and 100 kva. The 10-kva transformer would be installed, and a certain load growth assumed. The machine would calculate operating costs for each year as the load increased until a pre-set maximum peak load was reached.

Then the next larger size transformer would be installed and the process repeated, until finally the 100-kva transformer was changed out. At that point, the machine would average the annual cost of operation for all these ratings, and the run would be complete. This run was repeated for successively higher changeout loads.

How was life taken into account? A "base" transformer was assumed. This so-called "base" transformer was said to represent a transformer with the distribution transformer-type insulation system prevalent a year ago. This transformer would have an estimated life of 33 years when carrying a constant annual peak load of 160 per cent of rating throughout its life.

An expression was derived to determine the life of any other transformer under any other loading conditions. Thus, as the changeout loading point was increased with each successive IBM run, the life of the transformers decreased. The machine automatically took this into account by altering the depreciation rate (that is, the fixed annual charge) of the transformer.

Figure 4 shows the result. Curve A indicates the average operating cost of this whole line of transformers (from 10-100 kva) in $/kva/year. Note that,

(Continued on page 108)

Westinghouse expands computer center

◆ The Westinghouse computer center, started in 1955, and well-known to utility engineers for its "Powercasting" program, has recently undergone an extensive expansion.

"With several million dollars worth of the most modern equipment on the market today, we have assembled a combination scientific-commercial data processing center second to none in industry," A. C. Monteith, vice-president, apparatus products, declared.

"The tremendous capacity of this equipment, along with the advanced skill and talent of our personnel, will have a marked impact on our operating procedures, product design, and engineering philosophy," Mr. Monteith said.

An IBM 7090 computer was installed in December. It is the first such computer in operation in the Tri-State area. Other equipment includes a Remington Rand Univac, two IBM 1401 computers, an automated data plotter, and the latest data transmission devices. The engineering computer facilities also include three large-scale analog computers used for electrical systems simulation.

"With this equipment it is now possible for Westinghouse to pursue a total systems approach through integrated data processing functions to serve research, sales, design engineering, manufacturing, and accounting," Mr. Monteith said.

Programs already in operation at the new center include engineering design and application studies for a wide range of products from nuclear reactors and turbogenerators to small motors.

Powercasting, a group of computer programs developed by Westinghouse, provides detailed simulation of electric power systems for advanced system planning.

"Another interesting application at the center is the use of the 7090 computer to simulate operation of Prodac computers made by Westinghouse for control of highly complex industrial processes," Mr. Monteith said. "This makes it possible for us to assure completely pretested operation to the customer before installation."

Business system programs now operating in the center include shop loading and scheduling, sales analysis and statistics, and job shop simulation, as well as payroll and accounting programs.

Mr. Monteith said the East Pittsburgh Computer Center is one of the first in the country which combines both scientific and commercial work in the same integrated program.

The use of electronic computing for engineering calculations was developed in Westinghouse by the analytical department at the East Pittsburgh division under the direction of Dr. E. L. Harder, a nationally recognized authority on the subject, Mr. Monteith said.

"The expanded computer center will make it possible to take direct transmission of customer requirements from sales offices throughout the world, prepare engineering specifications, write the shop order, check inventory, schedule production, and prepare invoices," Mr. Monteith explained.

"The system will aid in the design and development of products in every price range, from small motors to the million dollar electrical power plants.

"Under the new system, Westinghouse engineers anywhere in the country will be able to transmit data to the center in the morning, get answers back, change their data, and get a second set of answers the same day," Mr. Monteith said.

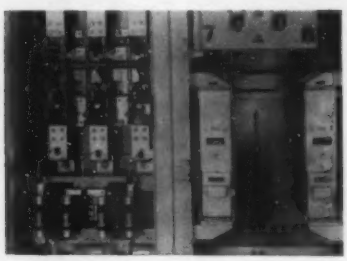
New utility equipment

S&C electric operator

New electric operators have been introducd by S&C Electric Co., 4435 N. Ravenswood, Chicago 40, Ill., for its high-voltage metalclad fused load interrupter switchgear for industrial plants, commercial buildings, and institutions.

This metalclad switchgear is used for 4.8- to 14.4-kv switching centers, substation primaries, substation secondaries, and service entrances.

S&C's electric operator uses a motor-operated, worm-driven gearhead powered by control circuits of 12, 48, 125, or 250 volts dc, or 120 or 240



volts ac. It can be manually operated. An interlock switch prevents motor operation when the hand crank is engaged.

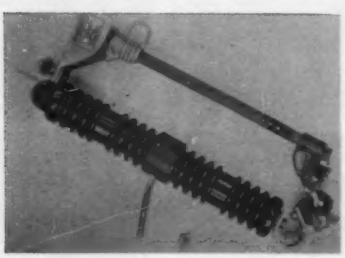
Accessories include indicating lamps to show load interrupter position, local control switches, electrical operation counters, and auxiliary switches for use with automatic switching arrangements.

Key interlocks and mechanical interlocks are available to insure properly sequenced operation with other equipment. A mechanical switch position indicator, viewed through an annunciator-like opening on the front panel, is standard equipment.

Write U-201 on reply card, pg. 17

Hubbard drop-out cutouts

Two new 27-kv open drop-out cutouts have been added to the Faultmaster line of Hubbard and Co., 200 S. Michigan Ave., Chicago 4, Ill.



These units feature the same service-proven, single-vent, small-bore design found in other Faultmaster cutouts.

The new cutouts have been individually designed and exhaustively tested. Both have a continuous current rating of 100 amps. No. 2580 has an interrupting capacity of 3,000 amps; No. 2581 an interrupting capacity of 6,000 amps. Mounting brackets and fuse holders are available for both new cutouts.

Positive operation is assured for all fault currents within the range of the cutout, and safety is assured because the single confined cone of gases is directed downward and away from personnel and equipment.

Write U-202 on reply card, pg. 17

Lapp ceramic magnet

A new type of long-life ceramic magnet for use in the oil level gauge on the Lapp POC and POC-A line of ASA standard bushings 15 kv-196 kv is available from Lapp Insulator Co., Inc., LeRoy, N. Y.

Two permanent type magnets in each gauge—one geared to the float in the oil reservoir, the other on the dial indicator outside of the reservoir housing—activate the gauge through the solid wall of the reser-

voir, indicating the level of oil inside the bushing.

Design tests have proved that the new ceramic or (cermet) permanent magnets can withstand surges of over 100,000 amperes without losing their magnetism.

The higher coercive force of the new material makes it ideal for retaining a high magnetic strength and permanent magnets of this new material have already found widespread use in the electronics industry.

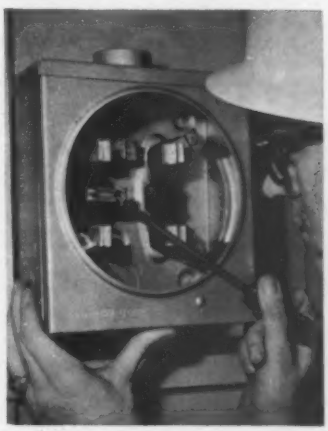
Oil level gauges with the new ceramic permanent magnets are now supplied as standard on all Lapp-ASA Standard Bushings.

Write U-203 on reply card, pg. 17

G-E ringless meter sockets

A new line of ringless meter sockets, flexible in design to accommodate individual electric utility requirements, is now available for 100- and 200-ampere single phase services, it has been announced by the General Electric Co., 1 River Rd., Schenectady 5, N. Y.

Constructed of 16-gauge zinc-coat-



ed steel, the new line is spot-welded throughout to provide weatherproof protection for the meter during its entire service life.

The sockets, type SI-60, are designed to keep socket installation and maintenance costs at an extremely low level.

The sockets are available in three sizes for 100-ampere ratings (eight inches wide, with lengths of 8.8, 10, and 12 inches), and two sizes for 200-ampere demands (eight inches wide, and lengths of 10 and 12 inches).

Six knock-outs are provided in the case sides, bottom, and back to permit the utility to select appropriate connections. Conduit ranging in size from one to 1½ inches in diameter can be accommodated.

Write U-204 on reply card, pg. 17

Cable accessory kit

The Epoxylite Corp., P. O. Box 3397, South El Monte, Calif., announces availability of their cable accessory kit, No. 715, for making hermetic potheadless terminations on 15-kv paper-lead cable.

Use of the new kit results in elimination of potheads on 15-kv cable for indoor service, offering considerable cost saving to utilities.

Cable is prepared in the normal manner, with construction of the conventional stress cone. Over this structure a laminate of special epoxy resin and orlon tape is then constructed by simple, brush-on tech-

niques. The laminate extends from the lead sheath to the terminal ferrule, providing a positive, oil-tight, moisture-tight termination. Such terminations have been subjected to overvoltage tests to establish a life expectancy in excess of 40 years.

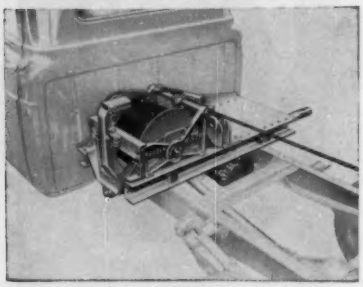
Potheadless terminations prepared in the above manner have been in field service in indoor locations for a period in excess of two years with no failures.

Write U-205 on reply card, pg. 17

Braden constant load winch

Braden Winch Div., Motor Products Corp., has developed what it claims to be the first major advance in winch design in nearly 30 years.

Originally designed to meet the special needs of utility companies,



this new unit is fast proving itself in industries from construction to logging and from oil well drilling to dredging.

The new Winch is the model CL (for constant load), and it is a hydraulic winch that combines constant load, constant speed, and constant horsepower with safe, efficient one-man operation.

Basis for the new cable-handling system is the separation of the power and storage functions of the winch, usually combined in a single drum. In the CL winch, two power drums do the pulling while a large capacity storage drum takes up the cable.

Write U-206 on reply card, pg. 17

EHV condenser bushing

A new 1,800-kv BIL condenser bushing which weighs 6,850 pounds and is 23½ feet high has been built for use on transformers with a high voltage rating up to 750,000 volts by Westinghouse Electric Corp., P. O. Box 2278, Pittsburgh 30, Pa.

The bushing brings the high voltage through the transformer cover and connects the transformer windings to the high voltage lines.

The bushing will be used in development work directed toward the ultra-high voltage transmission system of the future. One of the highest voltage commercial transmission lines presently operating in the United States is 345,000 volts.

Provisions were made on the 1,800-kv BIL bushing to assure low temperatures in the bushing conductor and insulation structure.

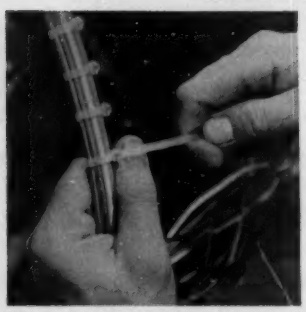
Write U-207 on reply card, pg. 17

Preformed dead-ends

Preformed Line Products Co., 5349 St. Clair Ave., Cleveland, Ohio, is furnishing as standard the cabled loop design on all popular sizes of its Guy-Grip dead-ends.

The preformed cabled loop Guy-

ELIMINATE TAPE, STRING, CLAMPS
with self-clinching
TY-RAP™
cable ties
and straps

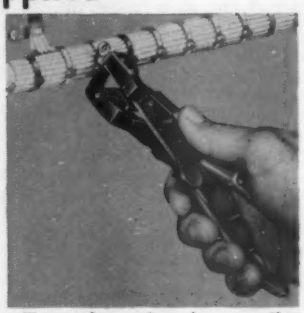


PAT. PENDING

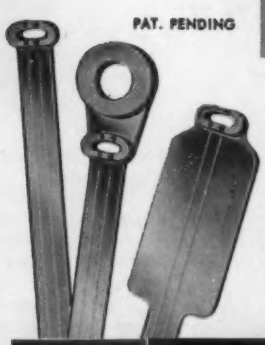
Neat, permanently secure cable ties and mounted bundles in seconds — with no strain on hands or conductors. Self-clinching lock won't loosen until intentionally removed. See your T&B Distributor or write to Thomas & Betts Co., Incorporated, Elizabeth 1, N. J. (In Canada: Thomas & Betts Ltd., Montreal; in England: Ross, Courtney and Company, Limited.)

T&B ENGINEERED THOMAS & BETTS

SPEED PRODUCTION — LOWER COSTS
. . . with tool-applied
TY-RAP™
cable ties
and straps



PAT. PENDING



For tying, clamping, coding wire bundles in original equipment . . . TY-RAP cable ties and straps and the new WT 183F Hand Tool save many dollars over other methods. Now in use by hundreds of OEM's and Contractors. See your T&B Distributor or write to Thomas & Betts Co., Incorporated, Elizabeth 1, N. J. (In Canada: Thomas & Betts Ltd., Montreal; in England: Ross, Courtney and Company, Limited.)

T&B ENGINEERED THOMAS & BETTS

CRESCENT

INTERLOCKED ARMOR POWER CABLE

GIVES YOU *SPEED* and *ECONOMY* OF INSTALLATION

Crescent Interlocked Armor Cable with ALUMINUM or GALVANIZED STEEL ARMOR provides a flexible metal-enclosed method of wiring for power. Speed and economy of installation are the principal advantages of these cables since they can be placed on easily hung racks or attached to building surfaces. Maximum current carrying capacity is secured by the use of the varnished cambric insulation. For outdoor or damp location installation, it is furnished with SYNTHOL IMPERVIOUS SHEATH between the insulated conductors and armor, as illustrated above.

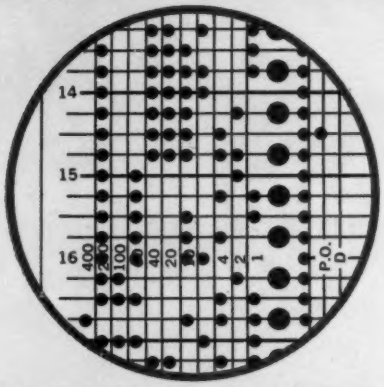
The Varnished Cambric insulated conductors are thoroughly protected by the Impervious Sheath of tough thermoplastic which is highly resistant to moisture, alkalies, acids and oils. This cable shows attractive savings when strung from messenger cables or in troughs outdoors or between buildings.

Crescent Interlocked Armor Cable also available with butyl rubber insulation.

CRESCENT INSULATED WIRE & CABLE CO., INC.

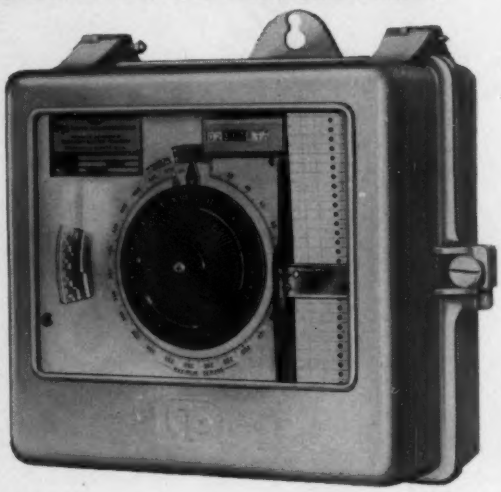
TRENTON, NEW JERSEY

SANGAMO DDR DIGITAL DEMAND RECORDERS



GIVE A VISUAL RECORD... PICK THE PEAK AND READ IT

Use for Load Analysis or Billing... Visually Interpret or Automatically Process the Punched Tape Record



A versatile demand instrument – the Sangamo DDR. This impulse operated block interval demand recorder is ideal for both survey and billing applications. The punched tape record can be interpreted visually, with ease and accuracy, or it can be processed automatically.

The DDR is available to you *now* for survey and billing... *whether or not your company has automatic data processing.* Where automatic data processing is not presently used, visual inspection of the punched paper tape quickly shows peaks and valleys... exact load values are easily interpreted. When processing is automated, the DDR then becomes an integral part of the system.

If your data processing is now automated, the DDR method means fast translation. Sangamo's translator permits direct, accurate and economical conversion of tape data. It can be used with your present key-punch equipment to produce punched cards, or fast translation service is available from Sangamo at a nominal cost. See your Sangamo representative for complete information or write for Bulletin 360.

SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

PW61-2

Grip dead-end, used at the top, breaker, and anchor rod, will be produced in a range of materials.

The cabled loop is durable. A smooth contour permits the loop to seat perfectly in the groove of the hardware. Cabled loop Guy-Grip dead-ends are capable of holding the full-rated breaking strength of the strand to which they are applied.

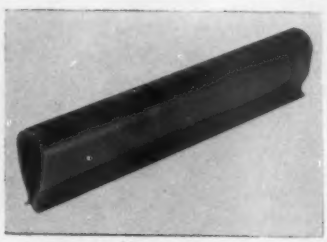
A major feature of the dead-end is easy tensioning when installing single or multiple guys. Re-tensioning, if ever required, is fast, safe, and easy.

Write U-208 on reply card, pg. 17

Hendrix Clip-On-Line-Duc

The Hendrix Wire & Cable Corp., Milford, N. H., announces a new Clip-On-Line-Duc which successfully prevents insulation and sheath abrasion by trees or other foreign objects and provides insulation values up to 15 kv.

It can be quickly and easily clipped on open distribution conductors,



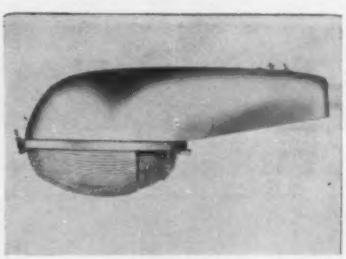
cabled service drops, and communication cables.

Made of a new type track-resistant polyethlene, the Hendrix Clip-On-Line-Duc offers the first and only practical encasement giving both high abrasion resistance and conductor insulation. It provides great economies by saving installation time, minimizing costly routine tree-trimming, expensive replacement of conductors and cables, and reducing customer complaints.

Write U-209 on reply card, pg. 17

Revere street luminaire

A new mercury street lighting luminaire available with built-in constant-wattage or high-power-factor reactor ballasts is now offered by Revere Electric Manufacturing Co., 7420 Lehigh Ave., Chicago 48, Ill.



Called the "Unitized Urbanoval," the new 2500 series luminaire is designed to provide uniform, low-level lighting most desirable for residential areas or secondary streets, using 100-, 175-, or 250-watt mercury lamps. It features modern precision cast aluminum housing with an integral slip-fitter in models to fit 1¼- or 2-inch pipe mounting arms.

The luminaire is available with or without a locking type receptacle for EEI-NEMA standard plug-in photoelectric control. A choice of two Revere-Corning Pyrex refractors provides ASA-IES type II or type II—four-way distribution patterns with clear lamps, or type III or type III—four-way distribution with phosphor-coated mercury lamps.

Write U-210 on reply card, pg. 17

L-M manual tap changer

A manual underload tap changer is available from Line Material Industries, McGraw-Edison Co., Milwaukee 1, Wis.

This tap changer can be furnished as an optional feature on all tapped distribution transformers rated ten through 167 kva, 2.4 through 14.4 kv.

Designed to maintain service continuity while changing taps, the manual underload tap changer is well suited to transformer installations where it is necessary to accommodate seasonally fluctuating or steadily increasing loads.

The external actuating dial has raised letters which indicate the position of the tap changer. Holes along the outer edge of the dial permit hook-stick operation.

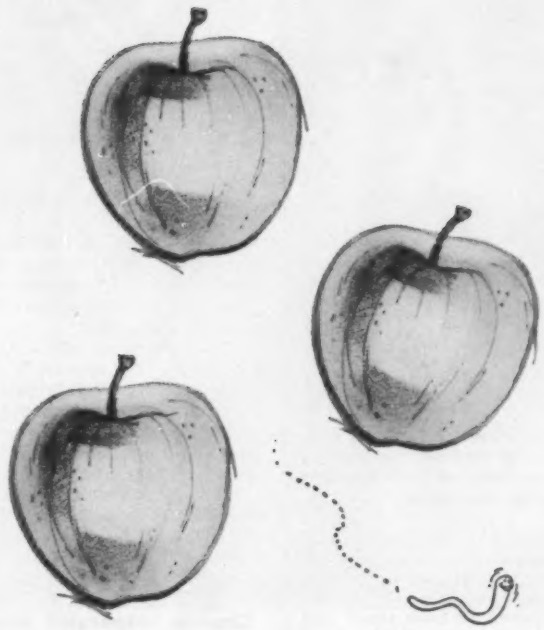
Protection of windings is achieved

by using resistors which limit the short-circuit current through the portion of the primary winding that is bridged during each tap change.

Write U-211 on reply card, pg. 17

Substation enclosure

Aluminum sign extrusions have been used by Union Electric Co., 315 North 12th St., St. Louis, Mo., to



you're right:
most photocontrols do look alike

If most of today's street light controls all look like first cousins — outside, inside and sometimes even in their guarantees — how can you pick out the good ones? You could try putting them all in service, but it would be the most expensive test you ever ran. Another way is to look at *what* components are used, *how* they're used in the circuit, and what the *field experience* of other utilities has been with the control.

Asking enough questions and getting realistic answers *before* you buy 10 or 20 thousand photocontrols pays off handsomely in street lights burning when they should — and in your getting to sleep at night. Fisher-Pierce Division, Sigma Instruments, Inc., 59 Pearl Street, South Braintree 85, Mass.

FP
FISHER PIERCE
Electrical and Electronic Equipment
for Industry, Utilities and the Home

You can buy Chance F2 Cutouts with confidence, sure that you're getting these advanced features so important for the protection you need:

- EXPENDABLE CAP assures wide-range operation on *any* fault. A small disc in the cap is ripped off on high fault currents, permitting the double-venting required to hold shock and strain to a minimum. On low and medium faults, the disc stays in place. By keeping the gases under the cap, the F2 single-vents to give protection against these lower faults.
- FUSE LINK EJECTOR makes doubly sure the cutout operates on low fault currents. Teamed with a small-bore fusetube, it assures low fault current interruption. Vitally important to load-break operation.
- POSITIVE LATCH holds fuseholder with a "bulldog grip"... keeps the cutout from opening under vibration or impact. Even if the fuselink is not installed tightly (or slips or stretches after installation), the fuseholder will not drop out. The latch cannot be welded shut because it is not a primary current-carrying element.
- ALL-BRONZE SLEET HOODS at both ends completely protect vital contact areas under all weather conditions. These all-bronze sleet hoods, and extensive use of copper alloy in the F2, guarantee trouble-free, peak performance, even in the most contaminated atmosphere.

  The F2, in voltages of 5.2, 7.8, 15 and 27 KV, and in 100 and 200 ampere ratings with interrupting capacities as high as 12,000 amps, are available from local stocks.

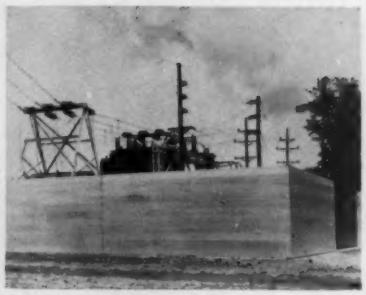
Chance F2 Cutouts are also available in combination with lightning arresters

CK60-36

A. B. CHANCE CO.

CENTRALIA, MISSOURI

(A. B. Chance Company of Canada, Ltd., Toronto)



build an attractive yet low-cost substation enclosure.

The 20-foot by 9-inch extruded sign sections, fabricated by Reynolds Metals Co., were erected at the company's Sunset substation in suburban Sunset Hills, Mo.

The company found this type of enclosure less expensive than metal picket fence, prefabricated redwood louver panels, and masonry walls.

The sign sections provide a neat, clean-looking enclosure that hides much of the substation equipment. This type enclosure was desirable at the Sunset location because it is located in a residential area.

Write U-212 on reply card, pg. 17

Chance suspension insulators

Weight savings and corrosion resistance qualities are new user benefits made possible by the use of aluminum caps and studs in the latest ten-inch extra-high-voltage suspension insulators, available from A. B. Chance Co., 210 N. Allen St., Centralia, Mo.

This innovation in transmission insulators makes them two pounds lighter than ordinary suspensions—as much as 64 pounds fewer on a

230-kv 16 double-string deadend. Reduced weight simplifies handling, transporting, and changing a string of insulators.

Aluminum hardware offers high corrosion resistance in industrial and marine atmospheres, and gives longer service life.

Write U-213 on reply card, pg. 17

RT&E transformer

R T & E Corp., 1900 E. North St., Waukesha, Wis., manufacturer of ground-level distribution transformers, has a new Terra-Tran design with additional safety features and greatly improved switching capabilities.

Referred to by RT&E as the "Saf-TT-Front" Terra-Tran, the new transformer design guards utility personnel from accidental contact with high voltage connections by encasing all primary voltage within a shielded and grounded compartment. With all hazardous voltage completely enclosed, the ground-level transformer is also "child-proof."

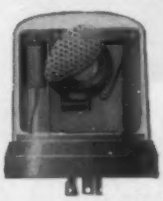
Also exclusive with the new RT&E

The Facts of Life in Street Light Control

1. Big killer of photo controls is transient voltage surges in secondaries which are below the spark-over of lightning arresters.

2. **LUMATROL MARK I** uses Varistors in conjunction with a secondary lightning arrester to withstand ALL transients up through the capabilities of the secondary arrester.

AUTOMATIC... COMPACT... LIGHTWEIGHT... SIMPLE... ...AND COMPLETELY RELIABLE!



WRITE FOR BULLETIN 91a.

MICRO BALANCING, INC.
GARDEN CITY PARK, N.Y.

In Canada: J. R. KEARNEY CORP.
Box 270, Guelph, Ont.

L & P Lighting Serves Its Agents

L & P's "partnership in business" begins with its own agents. They are the vital link between L & P, as manufacturer of fluorescent and incandescent lighting fixtures . . . and the distributors and their customers. For this reason, our agents are always welcome at the L & P plants in Olive Branch, Miss., and Memphis, Tenn. In fact, we make it a point to see that they visit us from time to time.

As a result, you'll find L & P agents know their products exceptionally well, from knockouts to ballasts, from lumens to louvers. You'll find that L & P agents are proud of their fixtures, too—for they know from personal experience that only the best of craftsmanship, materials, and performance emerge from the L & P assembly lines.

WHATEVER YOU NEED IN LIGHTING FIXTURES, ASK YOUR L & P AGENT. HE IS TRAINED, EXPERIENCED, AND DEDICATED TO SERVE YOU. YOU CAN TRUST HIM.

LIGHT & POWER UTILITIES CORP. L&P

L & P LIGHTING

OLIVE BRANCH, MISS.

1035 FIRESTONE BLVD. • MEMPHIS, TENN.

Another Partner In Business

When Gerald Preacher talks to customers who specify or buy L & P lighting fixtures, he knows what he's talking about. His experience covers 28 years . . . and touches all the bases. He's a graduate electrical engineer, to begin with — from the University of South Carolina. His first job was with a public utility, South Carolina Electric & Gas Company, in Columbia, South Carolina.

GERALD PREACHER

Next came a stint overseas, with the Hawaiian Electric Company, Honolulu, Hawaii. Then private business as consultant electrical engineer in Columbia, before becoming, in 1959, a manufacturer's agent for commercial lighting fixtures under the firm name of Gerald H. Preacher Company, Inc.

With such a broad and varied background, it is no wonder that Gerald shares with other L & P agents a sincere understanding of the problems facing the distributor. He, too, has seen distributors spend days of their time working out an electrical installation for a contractor — only to have that contractor use those ideas but give the sale to someone else.

"I suppose there'll always be price-cutters," Gerald says, "and people who know or care little about electrical fixtures except their price. But good contractors, like good distributors, realize that quality and service cost something, and have to be figured into any fair price. In the long run, these are the kind of people who make our industry a success. They're the ones who will help it grow, if we're going to grow at all.

"There's no doubt that the good distributors we deal with appreciate L & P's support in their conscientious effort to give continuing, reliable service. In turn, L & P is backing its agents in our effort to educate contractors to the value of being loyal to the distributors who do give such service. 'Service After the Sale' is an L & P tradition. Perhaps if we all plug away at it together, we can make it an industry tradition as well."

LIGHT & POWER UTILITIES CORP. L&P

L & P LIGHTING

Olive Branch, Miss.

1035 Firestone Blvd. Memphis, Tenn.

Distributed by Wholesale Dealers Only

There's an

L&P

Representative Near YOU!

For further information and prices on L & P fluorescent fixtures—standard or "custom-made"—check the following list, and phone or write the L & P representative nearest you:

(F—Fluorescent)
(I—Incandescent)

Associated Manufacturers Agents (F)
900 Carondelet St.
New Orleans, Louisiana

James E. Clary (F - I)
62 Flicker
Memphis, Tennessee

Craig-Owen (F - I)
306 E. 11th St.
Chattanooga, Tennessee

C. V. Hammon (F - I)
845 S. W. 52nd St.
Oklahoma City, Oklahoma

J. F. Hisserich (F - I)
2001 Big Bend Ave.
St. Louis, Missouri

Howard E. Johnson (F - I)
2976 Randy Lane
Dallas, Texas

Allan M. Kahoe (I)
8849 25th St.
Metairie, Louisiana

Richard B. Murdoch (F - I)
7300 Bailor Ave.
College Park, Maryland

William B. Murray (F - I)
531 Western Ave., N.W.
Atlanta 14, Georgia

N. B. Nichols (F - I)
2509 Bishop
Little Rock, Arkansas

Joe E. Pearce & Associates (F - I)
50 N. Kenmore
Indianapolis, Indiana

Gerald Preacher (F - I)
116 N. Church St.
Lexington, South Carolina

Irvin Spero (F)
4142 Stillmore Rd.
South Euclid, Ohio

Arthur H. Swartz (F - I)
2120 Polk Ave.
Houston, Texas

Light & Power Utilities Corp. (F-I)
P. O. Box 157
Olive Branch, Mississippi

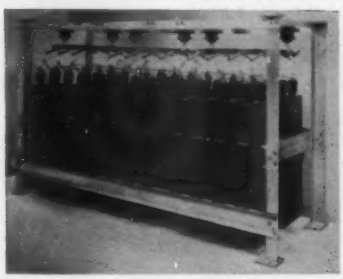
"dead front" design is full capacity load break switching suitable for loop or radial systems and for delta or wye connections as integral parts of both single and three-phase Terra-tran transformers.

Write U-214 on reply card, pg. 17

Cornell-Dubilier capacitors

A new Cornell-Dubilier 50-kvar power capacitor and 100-kvar "Slim Jim" power capacitor, both of which offer unique space-saving advantages as well as unusually cool operation, have been introduced by Federal Pacific Electric Co., 333 Hamilton Blvd., South Plainfield, N. J.

Rated 2,400 volts through 7,960 volts, 60-cycle, single phase with single or double bushings, the new power capacitors are engineered for



use in substation stack racks and pole-mounted racks on utility transmission and distribution systems.

The 50-kvar capacitor weighs 92 pounds, and has a case size of 15½ inches wide, 4½ inches deep, and 22½ inches high. The 100-kvar capacitor weighs 175 pounds and has a case size of 13½ by 4½ by 41½ inches.

The 100-kvar "Slim Jim" power capacitor has been especially engineered for space saving by the utility. With the same width and depth as the 50-kvar unit (13½ by 4½ inches, respectively), the 100-kvar unit—with the addition of only 19 inches in height—can provide twice the kvar per square foot as a rack with 50-kvar units.

Write U-215 on reply card, pg. 17

L-M SRT transformers

Electronic, self-regulating distribution transformers have been developed by Line Material Industries, McGraw-Edison Co., Milwaukee 1, Wis., specifically for use on 20/34.5-kv grounded-wye circuits.

These new transformers supplement L-M's line of SRT's previously developed for primary voltages at 2.4 through 14.4 kv. They offer definite economic advantages over other methods of regulating 20/34.5-kv grounded-wye distribution systems.

Constructed to meet the requirements of high-voltage distribution systems, the new SRT's have a 150-kv BIL. They are available in single-

phase ratings of ten through 167 kva with a secondary rating of 120/240 volts.

Solid-state electronic components are used in the SRT to sense voltage at the utilization level and control a shaded pole motor-driven tap changer.

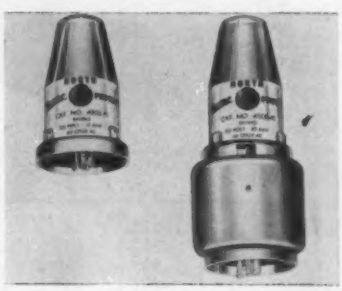
Write U-216 on reply card, pg. 17

Revere photoelectric control

New photoelectric light controls by Revere Electric Manufacturing Co., 7420 Lehigh Ave., Chicago 48, Ill., are light-sensitive switches which automatically turn on outdoor lighting installations such as street lights and service station lights at predetermined levels of darkness and turn them off when they are no longer needed.

Series 4005 is the basic control; 4006 series controls are equipped with an electric timer to preset any desired "off" period and temporarily override the photoelectric cell.

The control consists of a cadmium sulphide photoelectric cell with a high dark resistance of +5 megohms, which can operate continuously carrying 500 milliwatts of power. It also



features a hermetically sealed tungsten-mercury solenoid type switch with a load capacity of 20 to 30 amperes at 120 volts or 240 volts and an inrush current capacity of 130 amperes.

An air gap lightning arrestor rated at 1,000 volts rms with a critical sparkover at 2,400 volts is built into each control. The light level setting is adjustable from ½ to four footcandles. Normal factory setting is two footcandles.

Write U-217 on reply card, pg. 17

Open-refractor luminaire

An open-refractor luminaire consisting of an Alzak-processed aluminum reflector, standard NEMA head, and Joslyn-Holophane refractor is available from Joslyn Manufacturing and Supply Co., 155 N. Walker Drive, Chicago 6, Ill.

Easy to relamp because of an open

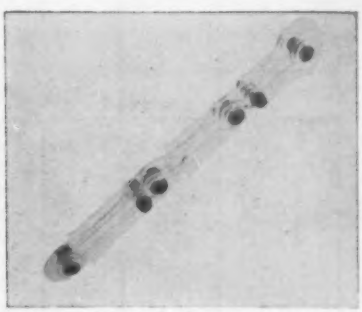
bottom, this luminaire accommodates incandescent lamps up to and including 6,000-lumen or 175-watt mercury lamps. It is ideal for residential street lighting as well as for suburban and rural yard lighting.

Write U-218 on reply card, pg. 17

Hendrix vertical spacer

A new 15-kv vertical Hendri-Clamp spacer for aerial cables is made available by Hendrix Wire and Cable Corp., Milford, N. H.

The new Hendri-Clamp consists of two identical halves of molded Plexiglas which are secured together by



a single Plexiglas assembly nut and bolt with self-locking threads.

The unit provides for a messenger and three conductor cables.

Write U-219 on reply card, pg. 17

New series of tables extended to include larger hourly rates

A NEW SERIES of estimating tables, completely revised in the light of more recent jobs and experience, are presented in this issue and will appear from month to month in forthcoming issues. These electrical estimating data sheets cover labor only and are arranged alphabetically with the basic material headings as a title for each tabulation.

Labor units given in these tabulations are based on a minimum of interference during work progress. The averages listed do not provide for abnormal job conditions, and any such abnormal conditions will require adjustments by the user, based on his experience.

The work units covered by each table are composed of one or more separate but closely related operations necessary for the complete installation of a particular basic item of electrical equipment. These operations associated with the basic material are described at the bottom of each table.

Most of the electrical estimating tabulations follow the same form. Column 1 at the left shows the size of the material to be installed. The second column from the left gives the time required to install the material, and it should be noted especially that this "productivity" column may be based on individual units or in the case of cable or conduit on units of 100 feet or 1,000 feet. The abbreviations "Ea." for each, "C" for hundreds, and "M" for thousands in Column 2 indicate the basis of the labor hours.

Columns 3 to 13, from the left, give the actual labor costs in dollars per unit of installation, at various hourly wage rates.

When calculations are being made for an hourly wage rate that doesn't correspond to any of the rates listed in Columns 3 to 13, the user may multiply the number of hours in Column 2 by 100 and this will give the labor cost based on an hourly wage rate of $1 per hour. By multiplying this by the hourly wage rate that actually applies in the user's locality, the exact labor cost of the operation may be obtained. Labor costs obtained in this way will be for units, hundreds of feet, etc., as given in heading of Column 2 of the table.

The labor units covered by the tables represent direct job labor costs and do not include delivery of material to site, engineering, estimating, or any other indirect cost.

As will be noted, some of the electrical estimating tabulations to be given will be for independent operations, such as excavating, backfilling, etc. These are included for use in preparing estimates on work of a special nature not covered under a specific table heading.

Tables will appear in alphabetical order.

CONCEALED — CONDUIT "ON CONCRETE SLAB" WAREHOUSE — THINWALL

COND. SIZE	HRS. "C"	LABOR COST INSTALLED PER FT. AT FOLLOWING RATES										
		2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50
1/2"	3.1	.062	.07	.078	.085	.093	.101	.109	.116	.124	.132	.14
3/4"	3.5											
1 "	4.2	.084	.095	.105	.116	.126	.237	.247	.158	.168	.179	.189
1 1/4"	5.6	.112	.126	.14	.154	.168	.182	.196	.21	.224	.238	.252
1 1/2"	7.1	.142	.16	.178	.195	.213	.231	.249	.266	.284	.302	.32
2 "	8.9	.178	.20	.223	.245	.267	.289	.312	.334	.356	.378	.401
		RIGID										
1/2"	3.7	.074	.083	.093	.102	.111	.12	.13	.139	.148	.157	.167
3/4"	4.1	.082	.092	.103	.113	.123	.133	.144	.154	.164	.174	.185
1 "	4.8	.096	.108	.12	.132	.144	.156	.168	.18	.192	.204	.216
1 1/4"	6.4	.128	.144	.16	.176	.192	.208	.224	.24	.256	.272	.288
1 1/2"	8.1	.162	.182	.203	.223	.243	.263	.284	.304	.324	.344	.365
2 "	9.0	.18	.203	.225	.248	.27	.293	.315	.338	.36	.383	.405

E-102-B

LABOR: Includes handling material at site, bending, cutting, reaming, threading, placing conduit, tying down and connecting at terminus.

2-61

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Bring out the best in Electric Heating with Honeywell quality controls

The new Honeywell T462 Line Voltage Thermostat offers the very finest for your economy-minded customers. A beauty in any room, this compact new thermostat gives dependable, worry-free performance—high load capacity plus accuracy and responsiveness. The new T462 was especially developed for electric heating, with a control range from 40°-85° with less than a ½° differential. The T462 offers everything you could ask for in a quality-built line voltage thermostat.

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First in Control

SINCE 1885

For complete specifications on Honeywell's full line of electric heating controls—including the most advanced low voltage control systems ever available to the electric heating industry—call your local Honeywell office. Or, write Honeywell, Dept. ES-2-13, Minneapolis 8, Minn.

CONDUIT "IN CONCRETE SLAB" STORES

CONCEALED — THINWALL

COND. SIZE	HRS. "G"	LABOR COST INSTALLED PER FT. AT FOLLOWING RATES										
		2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50
1/2"	4.0	.08	.09	.10	.11	.12	.13	.14	.15	.16	.17	.18
3/4"	4.3	.086	.097	.108	.118	.129	.14	.156	.161	.172	.183	.194
1 "	4.8	.096	.108	.12	.132	.144	.156	.168	.18	.192	.204	.216
1 1/4"	6.4	.128	.144	.16	.176	.192	.208	.224	.24	.256	.272	.288
1 1/2"	8.0	.16	.18	.20	.22	.24	.26	.28	.30	.32	.34	.36
2 "	8.8	.176	.198	.22	.242	.264	.286	.308	.33	.352	.374	.396
		RIGID										
1/2"	4.5	.09	.101	.113	.124	.135	.146	.158	.169	.18	.191	.203
3/4"	4.8	.096	.108	.12	.132	.144	.156	.168	.18	.192	.204	.216
1 "	5.5	.11	.124	.138	.151	.65	.179	.193	.206	.22	.234	.248
1 1/4"	7.3	.146	.164	.183	.201	.219	.237	.256	.274	.292	.31	.329
1 1/2"	9.0	.18	.203	.225	.248	.27	.293	.315	.338	.36	.383	.405
2 "	10.2	.204	.23	.255	.281	.306	.332	.357	.383	.408	.434	.459

E-102-B

LABOR: Includes handling material at site, bending, cutting, reaming and threading, placing conduit, tying down and connecting at terminus.

2-61

CONDUIT "ON CONCRETE SLAB" STORES

CONCEALED — THINWALL

COND. SIZE	HRS. "G"	LABOR COST INSTALLED PER FT. AT FOLLOWING RATES										
		2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50
1/2"	3.8	.076	.086	.095	.105	.114	.124	.133	.143	.152	.162	.171
3/4"	4.1	.082	.092	.103	.113	.123	.133	.144	.154	.164	.174	.185
1 "	4.6	.092	.104	.115	.127	.138	.15	.161	.173	.184	.196	.207
1 1/4"	6.1	.122	.137	.153	.168	.183	.198	.214	.229	.244	.259	.275
1 1/2"	7.6	.152	.171	.19	.209	.228	.247	.266	.285	.304	.323	.342
2 "	8.5	.17	.191	.213	.234	.255	.276	.298	.319	.34	.361	.383
		RIGID										
1/2"	4.3	.086	.097	.108	.118	.129	.14	.151	.161	.172	.183	.194
3/4"	4.6	.092	.104	.115	.127	.138	.15	.161	.173	.184	.196	.207
1 "	5.4	.108	.122	.135	.149	.162	.176	.189	.203	.216	.23	.243
1 1/4"	7.0	.14	.158	.175	.193	.21	.228	.245	.263	.28	.298	.315
1 1/2"	8.7	.174	.196	.218	.239	.261	.283	.305	.326	.348	.37	.392
2 "	9.8	.196	.221	.245	.27	.294	.319	.343	.368	.392	.417	.441

E-102-B

LABOR: Includes handling material at site. Bending, cutting and threading, placing conduit, tying down and connecting at terminus.

2-61

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News of the industry

edited for Southern readers

All-out campaign begun for electroluminescence

AN ALL-OUT drive to develop broad applications of man's newest light source, electroluminescence, in the architectural and interior design field, has been launched by Westinghouse.

F. M. Sloan, Westinghouse vice-president and general manager of the company's lamp division, has announced that company engineers have developed electroluminescence to the point where large lamps of this type may be used successfully and economically for a myriad of applications in the architectural, interior design, and decorator field.

Use of the unusual lamps will literally open up entirely new vistas in architecture and interior design, Mr. Sloan believes.

Electroluminescent panels, which Westinghouse calls Rayescent lamps, are actually flat panels of glass with an electrical conductive film. They are coated with a special phosphor. When electricity is applied, the panels glow. There are no filaments, tubes, or vapors, and practically no heat is produced. Not only are the lamps virtually fail-proof, but the current drain is almost negligible.

One of the most imaginative and extensive applications of electroluminescence ever undertaken will be installed in the Rice Hotel, Houston's famous convention headquarters hotel.

Marking the first large scale use of electroluminescence for decorative illumination anywhere in the world, the dramatic installation is part of a $5 million redecorating program undertaken by the 48-year old hotel. Plans call for a unique ceiling of electroluminescent light in the new lobby.

When work is completed early in 1961, it will climax completion of one of the most extensive hotel modernization programs ever undertaken.

According to Philip F. Dietz, manager of the Westinghouse Rayescent lamp department, the Westinghouse installation in the Rice Hotel will cover 521 square feet and will consist of 128 individual Rayescent lamps. The lamps will be blue in color to simulate the natural color of the Texas sky.

The dramatic Rayescent ceiling designed for the hotel's new lobby will be in a perfect ellipse 31 feet long. It was designed by the interior and industrial design firm of Richard Kent, Inc., of N. Y., which has been engaged to design the lobby, exterior entrances, and other areas of the Rice Hotel.

Tables with electroluminescent tops add a touch of the unusual to the Tower Suite Restaurant in New York's new Time & Life Building.

Tables with electroluminescent tops add a touch of the unusual to the Tower Suite Restaurant in the new Time & Life Building, in New York City.

The round tables have glass tops which emit a soft, pleasing candlelight glow which is flattering to the diners as well as to the table settings and decorations.

Plain marking required on commercial vehicles

POLICE at Tampa, Fla., are enforcing a newly enacted city ordinance, designed to protect electrical supply dealers, electrical contractors, other sales and service concerns, and the public which they serve.

The law requires that all commercial vehicles be plainly marked with the name of the owner in letters at least four inches high, the type of business, address, telephone number, and a registration number.

City officials emphasized that the law was not passed to annoy or inconvenience local established enterprises, but to protect them and their customers from unethical and dishonest sales and service operators who appear in Florida in numbers during the winter season, usually in door-to-door solicitation.

Florida home owners were defrauded of thousands of dollars last winter in shoddy construction, electrical, or other repair jobs. In many cases the imposters of electrical service and other repairmen never reappeared after taking orders and receiving down payments on merchandise they proposed to deliver or services they promised to perform.

Hoffman retires, sells company to employees

GARDNER HOFFMAN, president of Tennessee Armature & Electric Co., Knoxville, has just sold that large company to a group of employees.

Mr. Hoffman, for 14 years National Electrical Contractors Association governor for the Chattanooga-Knoxville-Tri-Cities (Johnson City, Kingsport, Bristol) zone, made the announcement at the start of 1961.

However, Mr. Hoffman said he has no intention of retiring—"that would be impossible for me." He will remain in an advisory capacity with the company and also personally look after several of his real estate investments.

New officers of the company are

Recently retired as president of Tennessee Armature & Electric Company is Gardner Hoffman, who sold the company to some employees.

Edgar W. McCall, president; C. D. Van Hoozier and Dabney Irving, vice-presidents; James E. Baumann, sec-

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Bronco Representatives in the South: FLORIDA, John R. Collins & Associates, 213 N. Willow Ave., Tampa 6; GEORGIA, Frank B. Davis, 708 Spring St., N. W., Atlanta 8; KENTUCKY, Fultz & Company, 2621 Valletta Road, Louisville 5; LOUISIANA, Dupont-Wachter Co., 609 Tchoupitoulas, New Orleans 12; NORTH CAROLINA, G. M. Hogshead Co., 201 W. Worthington, Dillworth, Charlotte 3; TENNESSEE, Ross D. Thomas Co., 198 So. Main St., Memphis; TEXAS, Jack Morgan Co., Inc., Dallas and Houston.

retary; and Robert Thomas, treasurer. They are the majority owners.

Tennessee Armature & Electric has 30,000 square feet of floor space and employs 130 workers. When Mr. Hoffman bought the business in 1929 it had a payroll of nine.

The new president, Mr. McCall, an Auburn engineering graduate, was with Westinghouse from 1934 to 1941.

Mr. Van Hoozier has been with the company since 1924.

Mr. Irving, a 1948 Georgia Tech graduate, came to the company in 1952 and became sales manager in 1958. He is from Atlanta, as is Mr. Hoffman, who also attended Georgia Tech.

Mr. Baumann, a veteran of the Battle of the Bulge and others, joined the company as an apprentice electrician after a period at the University of Tennessee.

Mr. Thomas joined the company just after graduation from Carson-Newman College in 1958.

New magazine to give attention to problems

THE FIRST ISSUE of *The Master Electrician*, a 16-page magazine of the Master Electricians Association of the National Capital Area, has been published.

Edited by Randolph W. Reed, Jr., of Reed Electric Co., the new magazine implements the purpose of the organization in calling member attention to local problems in need of collective solution. The new magazine will appear six times a year.

R. W. Reed, Jr.

Underscoring the association's purpose in promoting higher standards in the electrical industry, the magazine represents a membership in five Maryland and Virginia counties as well as the District of Columbia.

The first issue of 1,000 copies reviews the history of the association, proposed changes in the Code and electrical licensing laws, reports of committees, and social events.

"There was a time when electricians of different companies meeting on the same job did not acknowledge one another. There is no reason for it. We have common problems and

singly we cannot solve them. Collectively, with mutual understanding, we can," said Mr. Reed, citing closer relations for bettering the general welfare of electricians as an association purpose.

"If we get together professionally and talk over our problems, we'll get somewhere. If we come to know each other better through social gatherings, better understanding of our common aims will eliminate unethical and antagonistic practices."

Utility to grant loans for employees' heating

THE POTOMAC Edison System, Hagerstown, Md., will provide interest-free loans for employee electric home heating installations, effective immediately, according to Robert G. MacDonald, utility president.

In order to make it possible for the maximum number of employees to have electrically heated homes, the company will loan up to 35 per cent of an employee's base annual earnings.

Under this new policy, loans will be available to any permanent employee whose home, with the installation of approved electric heating, will qualify for the new all-electric rate, which went into effect in September, 1960.

Loans will be repaid in equal monthly payroll deductions, with no interest charged, and with up to ten years to repay.

Material sales to climb four per cent during '61

SALES of electrical contruction materials in 1961 are expected to increase four per cent over 1960, the Business and Defense Services Administration, U. S. Department of Commerce, has reported.

This increase will be a continuation of growth because sales in 1960 are anticipated to be approximately seven per cent greater than in 1959.

The electrical construction material industry is composed of manufacturers of current- and noncurrent-carrying wiring devices, lighting equipment, and secondary electrical distribution apparatus.

Of the different factors that influence the demand for such products, new construction is the most important—accounting for 76 per cent of an estimated $5 billion expenditure for all electrical construction work in 1960. Maintenance and repair accounts for the remaining 24 per cent.

In 1960, sales of the industry expanded even though the largest segment of total new construction (residential buildings, nonfarm) declined. This increase in sales was due primarily to the increasing influence of electrical construction in nonresidential building (nonfarm). This seg-

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POSITIVE PROTECTION with ARROW-HART GROUNDING Receptacles

SPECIFICATION GRADE

Now, positive grounding protection on commercial and industrial installations is assured with Arrow-Hart Grounding Receptacles built with *riveted* grounding contacts and terminals. The U-shaped double grounding contacts and terminals used in Arrow-Hart Specification Grade Grounding Receptacles feature a unique *one-piece construction of heavy 1/32" thick bronze — not brass.* This is mounted on the strap by a brass rivet, headed on both sides. *Exclusive with Arrow-Hart,* this rigid one-piece construction eliminates the possibility of loose joints and of parts turning in the grounding path . . . giving the operator dependable positive protection. Be *safe* — be *sure* — with Arrow-Hart's built-in quality and hidden values!

Complete information on ARROW-HART grounding devices is provided in the new booklet, "Grounding Facts". Write today for your free copy to: The Arrow-Hart & Hegeman Electric Co., Dept. ES, 103 Hawthorn Street, Hartford 6, Connecticut.

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Quality since 1890

WIRING DEVICES • ENCLOSED SWITCHES
APPLIANCE SWITCHES • MOTOR CONTROLS

ment of construction soared to a record level, exceeding $10 billion in 1960.

Although nonresidential building accounted for only 24 per cent of total dollar value of new construction in 1960, it accounted for approximately 55 per cent of the total electrical construction dollar volume. This segment of the construction industry is expected to increase in 1961, but at a slower rate.

It should also be noted that electrical work takes a slightly larger relative share of the construction dollar volume of residential building because of the increasing use of electrical appliances during recent years.

New developments in lighting methods and stepped-up industry promotion for more fixtures per home are expected to continue the trend toward more expenditure for lighting equipment in all types of construction.

Sales of lighting fixtures in 1960 were affected by the slump in residential building and are, therefore, expected to be lower than sales of 1959. Increasing sales of lighting equipment are anticipated in 1961 in line with the projected expansion of over-all construction activities.

The continuation of the rise in the quantity of electrical energy consumed by both residential customers and industry is another indication of a growing market for electrical construction materials.

For the 12-month period ending July 31, 1960, sales of electrical energy to residential, commercial, and industrial users increased by 10.2, 9.7, and 4.8 per cent respectively over the corresponding period of 1959. Energy sales for street and highway lighting also increased 7.4 per cent.

On the assumption that total construction will increase, and considering other factors, it appears that electrical construction material sales in 1961 will increase approximately four per cent over 1960.

Dates ahead

National Rural Electric Cooperative Assn., Annual Meeting, Dallas, Tex., Feb. 12-16, 1961.

Missouri Valley Electric Assn., Industrial and Commercial Sales Conference, President Hotel, Kansas City, Mo., Feb. 16-17, 1961.

Southern Safety Conference and Exposition, Atlanta Biltmore Hotel, Atlanta, Ga., March 5-7, 1961.

National Lighting Exposition, Coliseum, New York, N. Y., March 5-8, 1961.

IAEI, Mississippi Chapter, Heidelberg Hotel, Jackson, Miss., March 27-28, 1961.

Southeastern Electric Exchange, Annual Conference, Boca Raton Hotel & Club, Boca Raton, Fla., March 27-29, 1961.

AIEE South East District Meeting, Jung Hotel, New Orleans, La., April 5-7, 1961.

IAEI, Georgia Chapter, Forrest Hotel, Rome, Ga., April 10-11, 1961.

IAEI, Ellis Cannady Chapter, Carolina Hotel, Raleigh, N. C., April 12-13, 1961.

Missouri Valley Electric Assn., Engineering Conference, President Hotel and Municipal Auditorium, Kansas City, Mo., April 12-14, 1961.

Southeastern Electric Exchange, Engineering & Operation Section, Hollywood Beach Hotel, Hollywood, Fla., April 12-15, 1961.

IES Southwestern Regional Conference, Skirvin Hotel, Oklahoma City, Okla., April 16-18, 1961.

IAEI, Alabama Chapter, Tutwiler Hotel, Birmingham, Ala., April 17-18, 1961.

Fourteenth Annual Conference for Protective Relay Engineers, Agricultural and Mechanical College of Texas, College Station, Texas, April 17-19, 1961.

Alabama Electrical and Electronics Exposition, Second Annual Exposition, Birmingham City Auditorium Convention Hall, Birmingham, Ala., April 17-19, 1961.

IES Southeastern Regional Conference, Atlanta Biltmore Hotel, Atlanta, Ga., April 19-21, 1961.

IAEI, South Carolina Chapter, Cabana Inn, Spartanburg, S. C., April 20-21, 1961.

IAEI Five - Chapter Joint Meeting—Baton Rouge, George Welman, North Louisiana-East Texas, Texas, and Texas Gulf Coast Chapters—Windsor Hotel, Abilene, Tex., April 28-29, 1961.

National Assn. of Electrical Distributors, Annual Convention, Detroit, Mich., April 29-May 3, 1961.

IAEI, Florida Chapter, Casa Marina Hotel, Key West, Fla., May 5-6, 1961.

IAEI, Executive Council, Statler Hotel, Detroit, Mich., May 14-19, 1961.

IAEI, Virginia Chapter, Hotel Roanoke, Roanoke, Va., June 12-13, 1961.

AIEE Summer General Meeting, Cornell University, Ithaca, N. Y., June 18-23, 1961.

IES National Technical Conference, Chase Park Plaza Hotel, St. Louis, Mo., Sept. 24-29, 1961.

National Electrical Contractors Assn., Washington, D. C., week of October 9, 1961.

AIEE Fall General Meeting, Statler-Hilton Hotel, Detroit, Mich., Oct. 15-20, 1961.

IAEI, Southern Section, Grove Park Inn, Asheville, N. C., Oct. 16-18, 1961.

KC electric association chooses Allen president

C. J. ALLEN, branch manager, Frigidaire Sales Corp., was elected president of the Electric Association of Kansas City at the group's 49th annual meeting and Christmas party.

Mr. Allen succeeds E. D. Shiffler of the General Electric Co.

The new president has been a member of the association since 1944, and has served as committee chairman, director, and vice-president.

Vice-presidents elected, and their respective divisions, include: utilities div., M. C. Boogher, Missouri Public Service Co.; manufacturers div., W. C. Lounsbury, Sylvania Electric Co.; appliance wholesalers div., Dale Dothage, Continental Electric Co.; contractors div., G. E. Trinastich, Squire Electric Co.; supply wholesalers div., C. W. Schumacher, General Heating and Cooling Co.; dealers div., M. B. Magers, Vesto, Inc.; maintenance, repair, and service, Jack Launder, Independent Elec. Machinery Co.; mfg. agents and reps., Charles L. Arehart, C. L. Arehart Co.; and radio and TV broadcasters, Wm. A. Bates, WDAF and WDAF-TV.

Bunt to serve Johnson as new representative

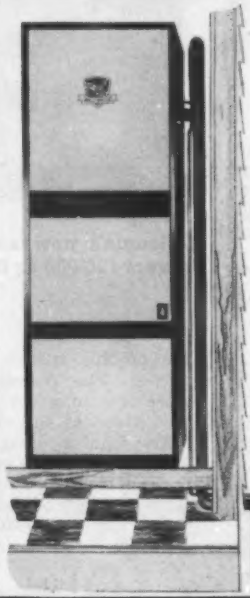
J. W. BUNT, formerly president of the Wells Electric Supply Co., Birmingham, Ala., has recently joined the Gene Johnson Co., Birmingham, as manufacturers representative.

BAR-BROOK
COOLING EQUIPMENT

BAR-BROOK BREEZEBUILDER-K
Fan and Ceiling Shutter Package
—*at the Lowest Price Yet!*

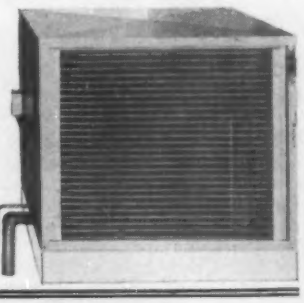
The low cost of the fan package enables the builder to include this extra sales feature in even the lowest price home. Top performance. Choice of either Bar-Brook KC or FHC Ceiling Shutter. Makes any installation easy, even in narrow halls. Attractive shutters are automatic and add to the decor of any interior.

Three fan sizes, 30", 36", 42". Quiet, rubber-mounted dual ball bearings 7000 cfm, 8500 cfm, 12,500 cfm. 1/3 H. P. motor, rubber mounted. Permanent "sealed-in" lubrication. Fan guaranteed 5 years; motor and belt guaranteed 1 year.



BAR-BROOK Year-'Round
Heating-Cooling AIR CONDITIONERS

3-Ton, 4-Ton and 5-Ton vertical closet-type units incorporating blower, heater and cooling coils. Companion Air-Cooled Remote Condensing Units. Also Blower-Heater Units available in Horizontal and Vertical Types. Write for special brochure.



BAR-BROOK Model FH ATTIC TYPE FANS

Comes in six sizes, with 30" to 54" fan blades. Can be used for both vertical and horizontal operation. Heavy-duty motors are rubber-mounted. Lifetime lubrication. V-belt life is prolonged and belt noise eliminated with exclusive Bar-Brook V-flat drive pulley. Square wood outer frame dampens vibration and simplifies installation. Listed by UL.

BAR-BROOK Model AVP PACKAGE UNIT

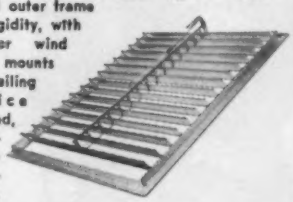
The very last word in a complete factory-assembled package system. UL Listed. Fan, motor, shutter and fuse link switch are all completely wired and ready to be installed. Ceiling trim is pre-cut --- just fasten in place. Comes in three sizes, with 31, 36 and 42-inch ceiling openings.

BAR-BROOK Safety Switch

The most rugged and compact safety switch on the market today. When the temperature reaches the indicated safety point, the "jacking action" of the small, cylindrical key forces the two halves of the Patented BAR-BROOK fuse link to spring quickly apart. 125, 135 and 165-degree capacities.

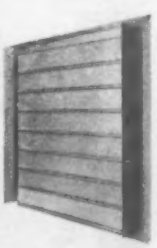
BAR-BROOK Model KC and FHC CEILING SHUTTERS

Nine standard sizes to fit ceiling openings from 31" to 96". Horizontal operation only. Quick-operating aluminum louvers open and close tight — automatically. Steel outer frame gives added rigidity, with no flutter or wind rattle. Shutter mounts flush with ceiling surface. Choice of air-operated, manually-operated or electric motor-operated shutters.



BAR-BROOK Model FHW WALL SHUTTERS

Six standard sizes to fit wall openings from 30 5/8" to 60". Attractive design features stucco-stipple aluminum louvers that open and close quickly and quietly. Louvers open fully to assure maximum efficiency and minimum air resistance. 4 1/2" metal shroud protects shutter from wind and rain. Choice of air-operated, manually-operated or electric motor-operated shutters.



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for free catalog, certified ratings and attractive prices.

BAR-BROOK MFG. CO., INC.

6135 Linwood Ave., Shreveport, Louisiana

The Cary Chapman Co.
600 Trusco Way, S. W.
Atlanta, Georgia

Arthur L. Pickens
P. O. Box 371
Mayfield, Kentucky

W. H. Faber Co.
6940 Wornall Road
Kansas City, Mo.

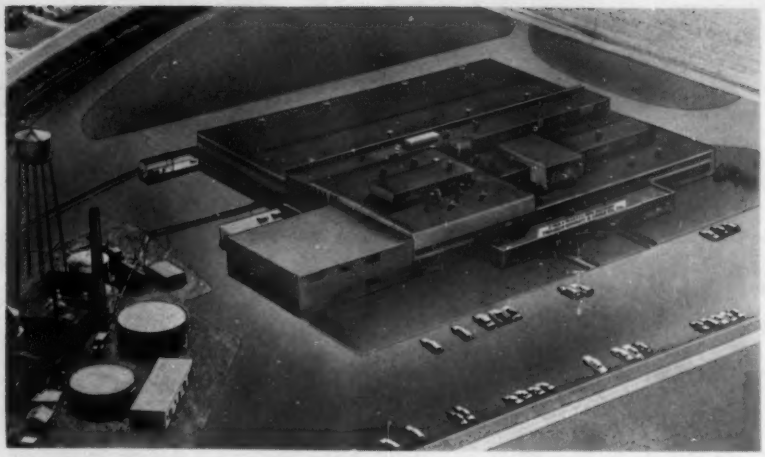
The Geo. E. Anderson Co.
1901 Griffin St.
Dallas, Texas

Mr. Bunt has been in the electrical industry for the past 15 years, covering utilities, co-ops, industries, and contractors.

At present the Johnson Company is representative for Bodendieck Tool Co., Fanner Manufacturing Co., Kerrigan Iron Works Co., Universal Pole Bracket Corp., Esco Manufacturing Co., Globe Co., Orangeburg Manufacturing Co., and Carleton Manufacturing Co.

Texas A&M to host relay engineers in '61

THE FOURTEENTH annual conference for protective relay engineers will be held April 17-19, 1961, at the Department of Electrical Engineering, Agricultural and Mechanical College of Texas, in College Station, Texas, according to an announcement from L. M. Haupt, conference chairman.



Triangle's new automated fiber products plant at Landisville, N. J., covers 120,000 sq ft, houses the company's Plastic Pipe Division.

Louisiana utility holds heating course

SIXTEEN STUDENTS recently completed the course in electric space heating conducted by Louisiana Power and Light Company for electrical contractors in the suburban New Orleans area.

Classes were held one night a week for five weeks and covered the subject of insulation, heat loss calculations, equipment types, operating costs, application information, the market for electric heat, builder and owner benefits, and sales techniques.

A highlight of the course was a panel discussion of electric space heating advantages by three home owners who have enjoyed the benefits of this system during the past winter. The members of the class were free to ask questions regarding all phases of the subject.

The final meeting was a dinner affair with a short review session. C. L. Osterberger, vice-president and sales manager of the utility, discussed plans for the future promotion of electric space heating.

A panel discussion of electric space heating advantages highlighted the recent heating course conducted by Louisiana Power and Light Co. Sixteen students completed the classes, which were held weekly for five weeks.

Brief news notes of manufacturers

TRIANGLE CONDUIT and Cable Co., Inc., newest entry into the fiber pipe field, has announced that its new bituminous fiber products plant at Landisville, N. J., is now in production. Product features were disclosed at the same time. All such product characteristics and features were based on extensive consumer product research. Most important include a transparent plastic coating to protect users' hands; color code stripe for easy identification; and long, labor-saving 10-foot lengths, as well as 8- and 5-foot lengths.

• • •

EDGAR E. DAWES and Co., Atlanta, Ga., has been appointed as representative in the wholesaling field for the sale of electrical connectors and allied products by Ilsco Corp., Cincinnati, Ohio. Their territory consists of Georgia, Alabama, and eastern Tennessee.

• • •

SQUARE D COMPANY has purchased from Gateway Erectors, Inc., Chicago, that portion of its business devoted to the manufacture of a complete line of steel duct for underfloor installation of electrical and communication wiring. Lawrence G. Maechtlen, Square D president, announced. The acquisition involves tools, equipment, inventories, and trademarks for the product.

• • •

A MODERN, three-year-old building on the outskirts of Cincinnati, in Blue Ash, Ohio, has been purchased from the American Can Co., by the Distribution Assemblies Dept., General Electric Co.

The building, which will be used to house the department's present facilities at Norwood, Ohio, together with new and modern production facilities to be installed, represents an investment of more than $3,500,000.

The newly purchased building is a single story, 243,000-square foot structure built on a 26-acre site.

News about people

Dan C. Kyker, electric utility sales representative for General Electric in Atlanta, Ga., has received the "Carter L. Redd Award" for "outstanding human and professional con-

Dan C. Kyker

tributions and unselfish service to his associates and the company," it was announced by the company.

Presentation of the award—a certificate and three shares of G-E stock—was made by Mr. Redd at a luncheon gathering of his business associates.

The award was established in 1957 by **C. L. Redd,** Southeastern regional vice-president of the company, for employees engaged in capital goods business in the seven-state Southeast area. It is offered annually to the employee who, in the opinion of a regional selection committee, has rendered conspicuous service to the community and to the company. Mr. Kyker is a 1946 graduate of Georgia Tech.

Robert R. Wylie was elected vice-president of Sangamo Electric Company at the recent meeting of the board of directors.

Mr. Wylie has been active in the utility industry for more than 20 years. He joined the Sangamo organization as marketing manager in

Robert R. Wylie

Facts of Light!

LARGE ROOMS USE LIGHT MORE EFFICIENTLY THAN SMALL ROOMS

The greater part walls play in a room, the more loss there will be before light reaches the ultimate working level. Also, the higher fixtures are, the greater will be the percentage of wall surface available to absorb light.

FADING CAUSED BY ARTIFICIAL LIGHT DEPENDS ON THE INTENSITY OF LIGHT

There is essentially no difference between incandescent and fluorescent light in causing fading of colored materials — it is the *intensity* of light that determines the effect. Open sunlight will fade materials much more rapidly than artificial light.

A LITTLE SOAP AND WATER CAN STOP THE LOSS OF HALF YOUR LIGHT

Dust and dirt allowed to accumulate on lamps and fixtures can reduce the light they produce by nearly 50%. The owning and operating cost remains constant. By knowing how fast light is depreciating, it is easy to figure amortization and power waste and establish a cleaning program that gives you maximum lighting economy.

MANY COST-SAVING HINTS IN THE CHAMPION LIGHTING MAINTENANCE MANUAL

This manual explains the principles and advantages of good lighting practice in 48 pages. Included are sections on group replacement of lamps, cleaning programs and a guide to trouble shooting fluorescent installations. This is the latest edition of a guide that has proved to be of great practical value to lighting men everywhere. Write for a free copy.

Your Best Buy in Lamps

CHAMPION LAMP WORKS, Lynn, Massachusetts

CHAMPION INCANDESCENT-FLUORESCENT

1957. His present assignment is vice-president — manager of electronic products sales.

The Board also moved **R. C. Lanphier, Jr., C. L. Clark,** and **D. C. Blanchard** to newly created senior vice-president offices.

Mr. Lanphier has been vice-president since 1939 and was named director of sales in 1957. Mr. Clark has been vice-president and treasurer since 1953, and Mr. Blanchard vice-president in charge of manufacturing since 1954. All are members of the board of directors and will continue their present responsibilities.

The executive director of the National Association of Electrical Distributors, **Arthur W. Hooper,** recently announced the appointment of **Francis X. Blackwell** as director of field activities for NAED.

With offices in Los Angeles, Mr. Blackwell will devote much attention

Francis X. Blackwell

to association work in the Central and Western regions of NAED, the announcement said. His last 15 years were spent in sales and sales management positions in the electrical industry on the west coast.

Roy A. Palmer, sales manager for the Duke Power Co., and well known for his activities in the field of lighting design and development, was recently awarded an honorary professional degree in electrical engineering by the University of Minnesota.

Clifford Becker has been recently named product engineer and sales manager of the Thiel Tool and Engineering Co., St. Louis, Mo., **Joseph Thiel,** president of the company, announced.

Mr. Becker was formerly with the A. B. Chance Co., Centralia, Mo.

Clayton L. Nairne, executive vice-president of New Orleans Public Service, Inc., has been designated as recipient of the Louisiana Engineering Society's 1960 Civic Affairs Activities—Andrew M. Lockett Medal.

The award is given annually to the Louisiana engineer who displays a high degree of interest and ability in altruistic community affairs. It is one of only two awards to be made by the society for 1960.

A native of New Orleans, Mr. Nairne received his early education at Rugby Academy and was graduated from Tulane University with a bachelor of engineering degree.

Robert M. Eichner has been named manager—rural electric system and municipal electric utility sales of the electric utility sales operation of General Electric Co., **M. F. Kent,** manager—electric utility sales operation, announced recently.

Until recently, Mr. Eichner was manager—component and intermediate distribution sales dept., Houston, Texas. His new headquarters will be in Schenectady, N. Y. Mr. Eichner graduated from Lehigh University in 1936 with a BS degree in industrial engineering, and joined General Electric following graduation.

Top executive realignment at Anchor Manufacturing Co., Manchester, N. H., including a new president and vice-president, was announced recently by the parent, Basic Products Corp., Milwaukee, Wis.

Ronald MacKay, executive vice-president and chief executive officer of Anchor for the past year, has been appointed the company's president. **F. E. Davis** resigned as president to assume new duties as vice-president and coordinator of new products research. **Robert L. Titus,** the company's sales manager, has become vice-president in charge of sales.

Mr. MacKay began his career in the electrical business as a manufacturers' representative in the field of electrical service entrance and time control equipment.

Mr. Davis joined Anchor in 1952 as manager of engineering. He became a vice-president in 1955, executive vice-president in 1957, and has been president since 1958. He is an electrical engineering graduate of the University of Virginia.

G. D. Leach, cooking and air conditioning engineer for Tampa Electric Co., has been promoted to commercial sales manager in the sales department of that company, it was announced recently.

W. Lee Mingledorff, Jr., former mayor of Savannah, Ga., has accepted a position with the Savannah Electric and Power Company as assistant to the president, **L. C. McClurkin,** president of the company, announced recently.

In that position, Mr. Mingledorff will carry out special administrative assignments, including civic activities

W. L. Mingledorff, Jr.

and industrial development. He is a graduate mechanical engineer of Georgia Institute of Technology.

Clyde O. Carpenter, Jr., widely known commercial manager of the Knoxville Utilities Board and a foremost community leader, died at a Knoxville hospital January 6.

He was regarded as one of the leading men in the nation in the commercial end of the utility field. Last year he was one of three utility men in the country to receive the Harold Kramer Personal Services Award at the annual convention of the American Public Power Association. He had received numerous awards, both for his business activities and his civic work.

He was a native of Macon, Ga., and started in the electrical field with Georgia Power Co. He later worked for some time in Chattanooga with the TVA before going to Knoxville in 1939.

Buchanan Electrical Products Corp., Hillside, N. J., has announced four organizational changes.

George Ustin has been appointed to the post of vice-president and general manager; **James O. Johnson** to director of sales promotion and advertising; **Albert Mittleman** to manufacturing manager; and **Charles F. Walker** becomes sales service manager.

Mr. Ustin has been vice-president in charge of engineering since 1959, having joined Buchanan five years ago. He holds a number of patents on electrical components and devices, and is a graduate of the City College of New York.

Mr. Johnson has been general sales manager at Buchanan since 1947. He is a graduate of Rennselaer Polytechnic Institute.

Mr. Walker, who has been sales office manager for the past four years, has also assisted Mr. Johnson in the company's advertising and sales promotion work. He was associated with electrical manufacturers in various capacities prior to joining Buchanan.

Mr. Mittleman has been with Bu-

chanan and its predecessor companies since 1942. He was first employed as a draftsman and has been plant superintendent since 1953. He attended the New York University engineering school.

Jay Johnston has been appointed the Wakefield Company's representative for the Kansas City, Missouri and Kansas areas. He will handle the firm's complete line of commercial and industrial lighting equipment.

A graduate of the University of Kansas with a BS degree in engineering, Mr. Johnston will operate from offices in Kansas City, Mo., known as the Illumination Sales Co.

After 30 years of service, Claude H. Jensen has retired as chief electrical engineer of Copperweld Steel

Claude H. Jensen

Company's Wire and Cable Division at Glassport, Pa.

A graduate electrical engineer of Washington State College, he has delivered many technical papers, as well as having had published a number of articles on grounding and grounding practices.

Central Transformer Corporation of Pine Bluff, Ark., announces the election of **Ralph C. Mitchell, Jr.,** to the office of executive vice-president and **John E. Caruthers** to the office of vice-president.

Mr. Mitchell joined Central in 1953 as sales manager and was elected vice-president and a director of the corporation in 1955.

Mr. Caruthers joined Central in 1955 as sales engineer and became assistant sales manager in 1957 and sales manager in 1958.

Joseph M. Costello, executive vice-president of South Carolina Electric and Gas Co., died unexpectedly on December 16, in Columbia.

For 40 years a prominent figure in the electrical power field, Mr. Costello was one of the industry's outstanding financial specialists.

NEW glamor NEW comfort

with Electromode's new infrared heater

This new Quartzone® Electric Heater makes every bathroom modern. It's the logical luxury touch in new homes, a "must" in remodeling.

What makes it different from many other heaters is the fact that it warms with infrared rays. As a result it warms people, not just the air. It puts an end to annoying drafts and overheating.

You'll like the ease of installation; it goes in as easily as an ordinary fluorescent lighting fixture. Mount it on a standard outlet box either in the ceiling or on any wall. It tilts 20° to direct warmth where it's most wanted.

And forget about costly call-backs with this rugged unit. That sturdy Quartzone tube stands up to sudden temperature changes and won't crack even if water splashes on it. There's also a chrome guard to protect the tube and the highly polished reflector plate.

The new Electromode Quartzone Bathroom Heater comes in two models, 120 and 240 volts. Larger units are available for outdoor applications.

For all the facts, contact your ELECTROMODE representative, or write to: Electromode, Dept. ES-21, Division of Commercial Controls Corporation, 570 Culver Rd., Rochester 3, New York

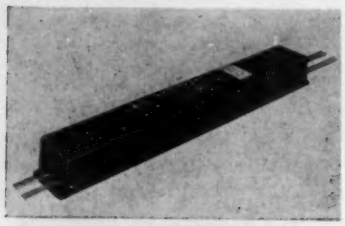
®Electromode

New products

Universal ballast

A low heat rise ballast, made by Universal Manufacturing Corp., 29-51 E. 6th St., Paterson 4, N. J., has been designed for use with 1500-ma rapid-start lamps.

With the introduction of its catalog No. 930-LH, the company has made



this type of ballast available for use in installations and fixtures with restricted heat dissipation.

The ballast can be used with 72- and 96-inch VHO, PG, SHO, T10, and T10J, 1500-ma rapid-start lamps to provide reliable starting at a low ambient temperature of —20 F. The 930-LH is CBM-certified by ETL only for 96-inch VHO, PG, and SHO lamps at a low starting temperature of 0 F.

Write P-220 on reply card, pg. 17

Grouped-motor control center

General Electric Co., 1 River Rd., Schenectady 5, N. Y., has announced 55 new features for added safety, flexibility, and reliability in grouped motor control—all within the compact enclosure of its new "Advanced-Design" Control Center.

The modern, versatile design of the new control center will save users space, installation time, and maintenance costs whereever two or more

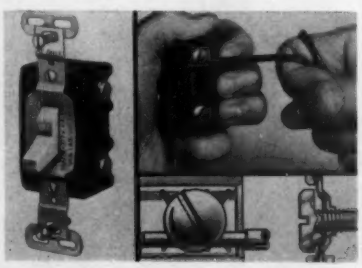
motors can be controlled from a central location.

Among the innovations, which are standard features in the new "Advanced-Design" Control Center, are the following: motor starter units with complete drawout connections for both power and control; "positive unit-guidance and racking" systems for starter units and double-spring-loaded power contacts to maintain connection even under fault for increased operational reliability; standard isolated and insulated vertical bus, enclosed in a glass-polyester "sandwich" for vertical dead-front protection—to safeguard personnel; and separate door for front access to the entire vertical wiring trough on each enclosure. Protected from operating units, the trough allows safe wire-pulling and connection of one unit while the rest of the center is operating.

Write P-221 on reply card, pg. 17

Sierra QuieT switch

Sierra QuieT switches manufactured by Sierra Corp., 15100 S. Figueroa St., Box 85, Gardena, Calif.,



offer the contractor new wiring convenience and dependability through the use of an exclusive terminal that combines the best wiring features of back- and side-wired designs. This new terminal has a three-fold advantage: it is quick to wire, the connection is positive, and it can be visually inspected.

Manufactured to exacting specification grade, these switches have an action that is smooth, quiet, and effortless. They will perform perfectly when mounted in any position.

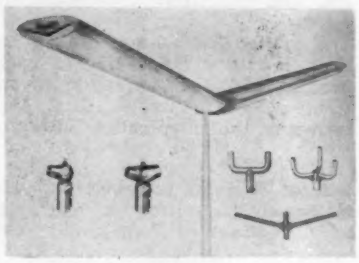
As in back wiring, the conductor (sizes 10 to 14 Awg) is inserted from the rear of the switch. The binding screw is then tightened with normal pressure. Because the terminal slot is open, as in side wiring, proof of a positive connection is made with a glance. This open slot also provides ample space for looping the conductor.

Write P-222 on reply card, pg. 17

Revere fluorescent Area-Lite

Revere Electric Manufacturing Co., 7420 Lehigh Ave., Chicago 48, Ill., announces the new 9900 Series Area-Lite fluorescent luminaire for service stations, parking lots, shopping centers, and other outdoor areas.

The 9900 Area-Lite series includes both four-lamp and six-lamp models, each for 96-inch or 72-inch HO, VHO, SHO, or Power Groove lamps. Both end-mounting and center-mounting



luminaire styles are offered together with a variety of pole-top fittings and brackets.

End-mounting units mount in single, twin, or triple arrangements. Revere poles recommended for installations of the new luminaire include both heavy duty and extra heavy duty tapered square rigid poles in 12-, 14-, or 16-foot lengths.

Write P-223 on reply card, pg. 17

Halo acoustical tile trims

A new work-saving series of acoustical tile trim rounds has been introduced by Halo Lighting Products, Inc., 4201 W. Grand Ave., Chicago 51, Ill.

By replacing one complete 12 by 12-inch tile, the new trim rounds eliminate cutting and piecing of ceiling tile during installation.

Each of the trim rounds has a 13-inch square frame which overlaps onto adjacent tiles. All styles have unwired housings in the H4100 series.

Styles include the baffle downlight (No. H4101), a high intensity downlight where low brightness is desired; the open adjustable (No. H4111), the beam of which can be directed where desired by adjusting a sliding socket; and the parallel louvered adjustable (No. H4121), which has a parallel louver which adjusts to the beam direction.

Other styles are the open ellipsoidal downlight (Nos. H4131 and H4141),

which has an ellipsoidal Alzac reflector which produces a controlled wide-angle beam using a general service lamp; and the louvered eyeball (No. H108-89), which is designed for installations requiring peak lighting efficiency with a decorative touch.

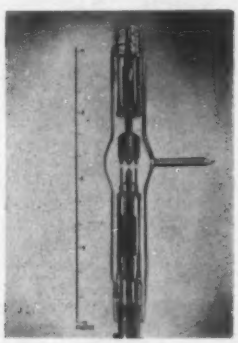
Write P-224 on reply card, pg. 17

Duro-Test xenon bulb

A major break-through in the field of xenon high brightness, long-range illumination has been achieved by the Duro-Test Corp., North Bergen, N. J., in cooperation with the United States Army Engineer Research and Development Laboratories.

Xenon high pressure, high brightness bulbs are a new type of powerful lamp for military use, searchlights, projectors, and space applications. The rays of the xenon lamp can be projected for a distance of 50 miles.

In one "envelope," the bulb has three brilliant arc discharges spaced approximately one-quarter of an inch from the other, differing in this way from one-arc conventional lamps. The availability of the three closely



spaced arcs, which can be switched and regulated independently, makes the lamp particularly useful for military and space applications, as well as commercially.

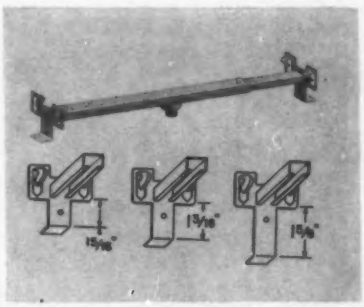
Some of the advantages of the xenon bulb over carbon lamps are the clean, maintenance-free operation; no open flame; no carbon fumes; perfect daylight color of light; and long-life of up to 1,000 hours.

Write P-225 on reply card, pg. 17

Steel City bar hangers

Two new adjustable bar hangers designed to save valuable installation time in dry wall board and plaster construction are available from Steel City Electric Co., 1207 Columbus Ave., Pittsburgh 33, Pa.

Pre-set depth of footed end plates enables the electrician to set and mount bar hangers accurately for plaster or dry wall board finishing. The foot of the end plate seats against the bottom of the joist and is automatically positioned. Integral nail-



like prongs on each end plate permit quick mounting of the bar hanger without nails.

The rectangular cross section of the sliding double bars, continuous from end plate to end plate, provides rigidity and great strength for mounting of electrical fixtures.

Write P-226 on reply card, pg. 17

Westinghouse fluorescents

A new line of high efficiency fluorescent lamps has been expanded by the lamp division of Westinghouse Electric Corp., MacArthur Ave., Bloomfield, N. J. The lamps were first introduced a few months ago and were designed to achieve one objective—maximum economy—the most light for the money.

Four additional lamps are being added to the line, which previously included a 40-watt lamp and a 96-inch slimline. The high efficiency fluorescent lamps provide 15 per cent more light than cool white lamps, and 36 per cent more than daylight type lamps, as the result of a new phosphor combination.

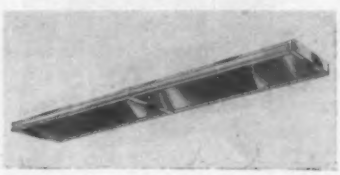
Producing 3,200 lumens, compared to 2,800 for ordinary 40-watt fluorescent lamps, the new product also has excellent light maintenance characteristics.

New high efficiency lamps provide the way to boost footcandle levels immediately, substantially, and economically. No changes in ballasts, lampholders, starters, or wiring are required. They snap right into existing fixtures.

Write P-227 on reply card, pg. 17

Mitchell luminaire

The new low brightness Skylark luminaire made by Mitchell Lighting Div., Compco Corp., 1800 N. Spaulding Ave., Chicago 47, Ill., utilizes a white polystyrene side diffuser and a crystal clear low brightness bottom panel.



The extruded polystyrene panels are formed so that they interlock, thus no metal framing is required. The resulting appearance is a fully luminous diffusing plastic enclosure with no dark areas. Polystyrene diffuser is color stabilized.

The apparent depth of the fixture is 2⅞ inches, resulting in an ultra-thin design. The polystyrene enclosure is hinged from either side of the fixture for easy lamp replacement and fixture cleaning, or can be completely removed—all without the use of any tools.

The fixture can be suspension- or surface-mounted.

Write P-228 on reply card, pg. 17

Nutone electronic chimes

NuTone, Inc., Cincinnati 27, Ohio, has answered the increasing demand for electronic chimes with two built-in models that can be connected to its intercom-radio.

Model L-72, with walnut frame, gold-flecked grille cloth, and anodized control panel, is designed to match the remote speakers of Nu-

Tone's stereo system. Chime volume is adjustable—eight or four notes may be selected for the front door, one note for the rear door, and a different note for the third door.

Model L-71, with gold anodized frame and desert sand grille, has volume control and two notes for the front door, one note for the rear door.

In both, the chime sound is relayed electronically into all rooms with speakers and can be heard above music or radio. It sounds clearly, even when the stereo or intercom systems are turned off.

Write P-229 on reply card, pg. 17

G-E cooler ballast

A new fluorescent lamp ballast that operates eight to ten C cooler in representative commercial fixtures than the model it supersedes has been introduced by General Electric Co., 1 River Rd., Schenectady 5, N. Y.

Designated model 6G1015, the new ballast is a series sequence design for 277-volt operation of two F96T12

or two F72T12 instant-start fluorescent lamps in commercial applications.

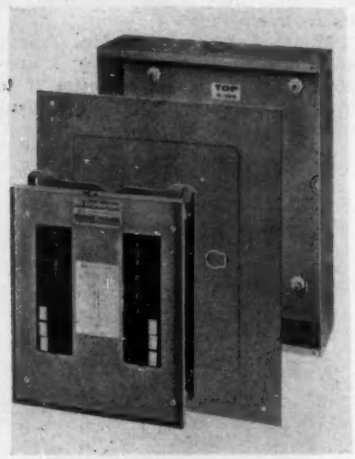
There is no change in the cross section or length of the new ballast. This allows the ballast to be completely interchangeable with the former model.

Designed for proper fluorescent lamp starting at a minimum temperature of 50 F, the new ballast is "C" sound rated and has a power factor above 90 per cent. It meets all requirements for CBM and UL general listing.

Write P-230 on reply card, pg. 17

I-T-E Uni-Pak loadcenters

Two major changes in circuit breaker loadcenters have been introduced by the Walker Division of I-T-E Circuit Breaker Co., 125 Bennett St., N. W., Atlanta 9, Ga. The first is a complete new line of Uni-Pak loadcenters for the EQ-T dual circuit breaker, and the second is the new 100-ampere two-pole EQ-P circuit breaker. The loadcenter incorporates the new non-interchangeability provisions.



The EQ-T dual circuit breaker is a new dual breaker physically the same size as the single pole EQ-P circuit breaker, but consisting of two separate half size independently operated breakers thus permitting two poles to be housed in the same space that was previously required for a single pole breaker.

EQ-T duals are designed for use in residential loadcenters and panelboards and feature a thermal-magnetic trip design with a low instantaneous trip setting, thereby providing positive protection for both overload and low magnitude fault currents.

Write P-231 on reply card, pg. 17

Prescolite outdoor fixture

Prescolite Manufacturing Corp., 2229 Fourth St., Berkeley, Calif., has a new weatherproof fixture for flush

installation in earth, concrete, or plaster, designed for outdoor installation in gardens, around commercial buildings, etc.

All-cast aluminum construction assures maximum corrosion resistance, and the unit is fully sealed to meet all weather and grade conditions. The fixture is designed for a 150-watt par 38 flood or spot lamp, sealed beneath a clear-crystal tempered lens. Internal adjustment permits aiming of the lamp in any direction up to 30 degrees off the vertical.

The standard unit measures 9 by 9 inches and is tapped for ½-inch conduit side entry. Other sizes and entry locations are available when specified.

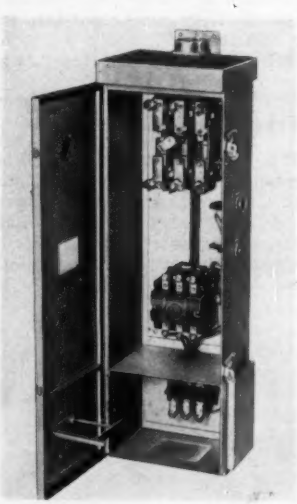
Write P-232 on reply card, pg. 17

Arrow-Hart motor controls

The Arrow-Hart & Hegeman Electric Co., 103 Hawthorne St., Hartford 6, Conn., is producing a new line of motor controls designed to start, stop, and protect electric motors on irrigation pumps and deep well pumps of the turbine and other similar types.

Known as the type "IP" irrigation pump controls, these units are electrically similar to combination starters, but are provided with special rain-tight enclosures. Each control is a single, neat, compact unit that consists of a fusible disconnect switch or a circuit breaker mounted in series with an Arrow-Hart type "CRA" contactor.

Two or three overload protective relays are provided, as specified. The enclosure is separated into two compartments. The upper section, which is not ventilated, houses the disconnect switch and the contactor. The overloads are isolated in the lower compartment, which is adequately ventilated to prevent overheating and subsequent nuisance tripping of the overload relays.



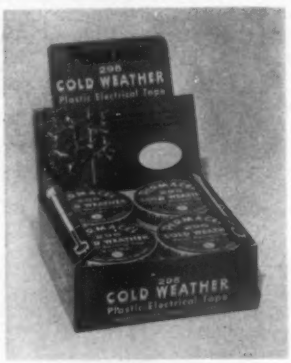
Write P-233 on reply card, pg. 17

Permacel plastic tape

A new pressure-sensitive, plastic tape for electrical wire splicing, which will remain flexible at temperatures as low as -50 F, has been developed by Permacel, New Brunswick, N. J.

Designated Permacel 295, the black plastic tape was specifically engineered for use in outdoor applications in cold weather or low temperature indoor splicing such as cold locker rooms, freezer plants, etc.

The new tape has an overall thickness of 8.5 mils with excellent tensile strength, 135 per cent elongation, superior dielectric strength and insulation resistance, as well as high adhesion. The tape will conform snugly to irregular surfaces, assuring a tight bond with minimum of tape build-up.



Although designed for cold weather usage, it will perform equally well in moderate temperatures, and remain serviceable under operating temperatures up to 180 F.

Write P-234 on reply card, pg. 17

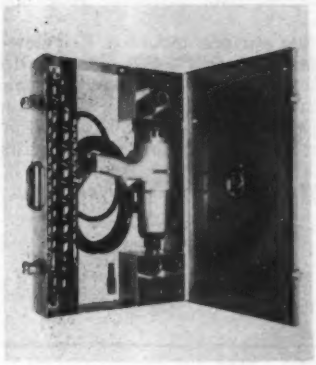
Albertson lineman's kit

Installation of cross arms on poles is considerably speeded, according to Albertson & Company, Inc., Sioux City, Iowa, with use of their new lineman's all-purpose kit #336C.

Basically, the tool is a Sioux #336 electric impact wrench with a 7/16-inch quick change chuck.

Nine bits from ½ by 10 inches long to 11/16 by 18 inches long and nine double square, extra long sockets from 9/16 to 1 11/16 inches are furnished with the wrench in a steel case.

The powerful impact wrench bores rapidly. The quick change chuck



makes possible a rapid change to the socket for nut running and tightening.

Write P-235 on reply card, pg. 17

Eagle fuse packaging

Since the National Electrical Code has made it mandatory to use non-tamperable time-delay type plug fuses in new construction, Eagle Electric Manufacturing Co., Inc., 23-10 Bridge Plaza S., Long Island City 1, N. Y., has introduced a new fuse top design and new packaging.

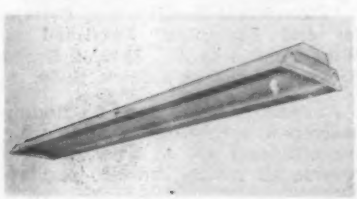
Merchandised in the colorful, cellophane-wrapped Eagle Sho-Pak, the Eagle non-tamp fuse, catalog No. 675,

is in constant view with the non-tamp shape easily identified. The cellophane-wrapped "Sho-Pak" also eliminates pilferage, keeps the fuses clean, and builds up quantity fuse sales. Space is provided for stamping the price.

Write P-236 on reply card, pg. 17

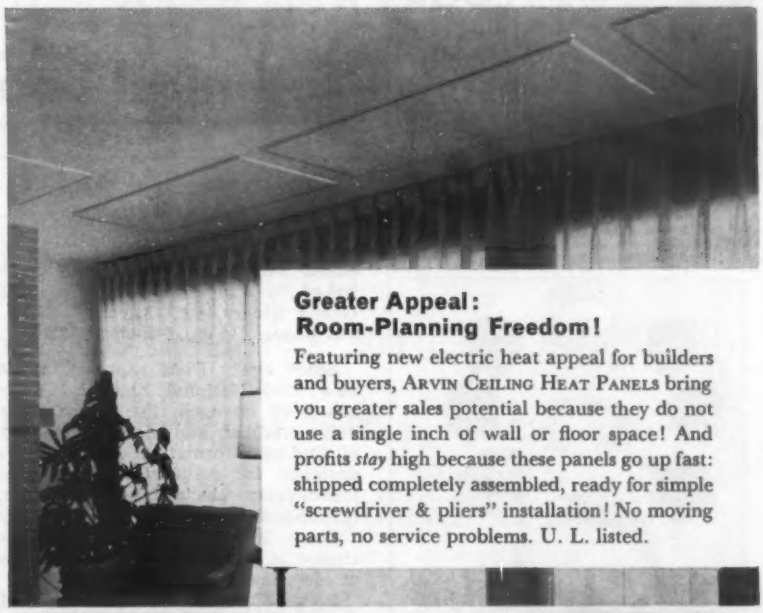
Day-Brite four-lamp unit

Day-Brite Lighting, Inc., 6260 N. Broadway, St. Louis 15, Mo., announces the Fairview-IV, a new four-lamp wide commercial unit, with one-piece Cleartex enclosure.



Arvin Electric Invisa-Panels solve your space problems . . . and they're more profitable, too!

(Shown as Featured Recently in a Better Homes & Gardens Idea Home)



Greater Appeal: Room-Planning Freedom!

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Sells On Size—1¾" Thin, 4½" Low! Pre-Wired: Fast, Easy Installation!

ARVIN ELECTRIC INVISA-BASEBOARD HEAT gives you the most *sellable* units available, slimmest and thinnest of all! Save time, keep profits up: units completely pre-wired for fast connection *from either end* to rough-in. High or low wattage, various lengths. Matching accessories.

ARVIN BUILT-IN WALL HEATERS

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Int'l H&AC: Booths N230 & N232—Chicago Amphitheater

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BOX

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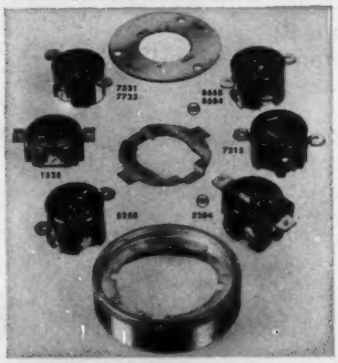
This 4" standard octagon, brass-topped, watertight, 2½" deep box is our #190 series.
Box-body has a 3¼" opening which makes it easy for whole hand access from top of concrete to bottom of floor.
A brass adjusting ring with ½" height adjustment in addition to three screw legs 2½" long, gives quick and easy "tru-leveling".
A "KEY" which fits most popular size and style receptacles has been added at no extra cost.



TO INSTALL — Drop the "KEY" (shown in center of photo) into special slots built into adjusting ring — select the receptacle required and simply "LAY-IN"; then "LAY-ON" receptacle ring.

Short Stem
TELEPHONE
and
DUPLEX
NOZZLES

Shorter styled, modern, compact, flanged duplex telephone and receptacle nozzles in satin brushed brass or anodized aluminum. Standards fit ½" opening. 3/4" stems available.

PIPE or
CONDUIT
CLAMPS

Malleable iron, with case hardened tool steel in one end of clamp in the form of an inverted V shape to give a double bite. Two models — "Parallel" and "Right Angle" — 11 sizes each- for 3/8" thru 4" pipe.

Sold Only Thru Wholesalers

Fullman
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COMPANY
1209-1215 JEFFERSON ST.
LATROBE, PENNSYLVANIA

The new unit is light in weight and designed for easy installation. Measuring only 14 inches in width, Fairview-IV avoids the bulky look of most four-lamp fixtures. Four-foot units accommodate four rapid-start lamps and can also be obtained for two or three rapid-start lamps. Eight-foot Fairview-IV is available in tandem rapid-start or eight-foot slimline, two, three, or four lamps wide.

The surface mounted Fairview-IV measures only 4⅜ inches deep. Translucent white plastic side panels provide soft ceiling illumination. Cleartex bottom panel offers prismatic control for low-brightness lighting.

Write P-237 on reply card, pg. 17

Technical books

for the electrical man

Code index

"Criss-Cross Index of the 1959 National Electrical Code Book." Published by Wing Publishing Co., 3940 Grand River Ave., Detroit 8, Mich., 153 pages, 4½ by 6 inches, $3.00.

Since every Code number in the new 1959 National Electrical Code has been changed, the index guide helps establish a quick and easy way of finding information. The guide is designed for contractors, architects, journeyman electricians, inspectors, training classes, etc.

Some 26 new categories are included in this index, plus four pages of electrical formulas.

Plastic bound, the book lays flat when opened.

Electromagnetism text

"Electromagnetic Fields, Energy, and Forces," by Robert M. Fano, Lan Jen Chu, and Richard B. Adler, all of the Massachusetts Institute of Technology. Published by John Wiley and Sons, Inc., 440 Park Ave., New York 16, N. Y.; 520 pages, illustrated, $12.00.

In this book, the authors develop a consistent macroscopic theory of electromagnetism, and discuss the relation between circuit theory and field theory. The theory is developed in successive steps from the Lorentz force, the integral form of Maxwell's equations in free space, and suitable macroscopic models of polarized and magnetized matter.

Included is the electromagnetism of moving bodies and the process of electromechanical energy conversion. A power-series technique for analyzing quasi-static fields and quasi-stationary systems is also introduced. Emphasis is placed on the synthesis of fields as opposed to the analysis of fields. Also presented, in an appendix, is the four-dimensional relativistic formulation of macroscopic electrodynamics recently developed by one of the authors, Mr. Chu.

This book is part of a group of such books comprising the M.I.T. "core curriculum" for electrical engineering students. This hard core of essential information is assembled from classroom experience and intensive research, and presents a new synthesis of basic subject matter.

Circuit noise

"Electrical Noise," by W. R. Bennett, Data Communications Consultant, Bell Telephone Laboratories. Published by McGraw-Hill Book Co., Inc., 327 West 41st St., New York 36, N. Y., 288 pages, 106 illustrations, $10.00.

How noise originates in electrical circuits, the terms in which it is described, how it is measured, and how circuits may be designed to minimize undesirable effects from noise are presented in this book.

It describes in qualitative and quantitive terms the physical nature of various important noise sources, including thermal agitation or resistance noise, shot noise in vacuum tubes and semi-conductor junctions, and noise from spontaneous emission of electromagnetic radiation. The relation of signal and noise in communication systems of various types is also included.

Coverage of recent advances includes a treatment of noise in transistors, masers, and parametric amplifiers. Among the subjects of special interest are the properties of thermal noise and its relation to black body radiation, and an introduction to elementary mechanics which is woven into the discussion of the maser and of noise in semiconductors.

In addition to the standard theory of noise figure and its significance, a treatment is given of the Haus-Adler theory of noise measure.

Electrical formulas

"Electricians Handbook of Formulas and Examples." Published by Wing Publishing Co., 3940-46 Grand River Ave., Detroit 8, Mich., $5.00.

Answers and directions for finding answers to such problems as figuring the efficiency for a motor, how to reverse all motors, how to regulate

1960 LIGHTING DIRECTORY STILL AVAILABLE

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Copies of this valuable directory of the lighting industry, containing more than 15,000 listings in 500 categories are still available from the publishers at $5.00 per copy. In addition to the buyers' guide section, listing the names of manufacturers of more than 500 different types of lighting fixtures and accessories, this latest issue contains the all-new manufacturers' representatives' section, which will enable lighting men to locate a manufacturer's nearest representative. Send orders to

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motor speed, how to locate the locked rotor amperes for a motor with only the horsepower and the Code letter, and how to use Ohm's law to solve problems, are covered in this book. These are only a few of the valuable facts included in the publication.

The book is spiral plastic bound.

Helpful literature

available to our readers

A new catalog just issued by **Stonco Electric Products Co.**, 333 Monroe Ave., Kenilworth, N. J., describes their complete line of new higher-output mercury vapor weatherproof **floodlights** for low-cost wide-area lighting of parking lots, ball fields, industrial, and architectural sites. Included are illustrations and specifications on single units and clusters for pole-top, mid-pole, wall, or surface mounting, with or without integrally mounted transformers.

Write B-238 on reply card, pg. 17

Bulletins 8145 and 8148 have been published by **Federal Pacific Electric Co.**, 50 Paris St., Newark 1, N. J., covering, respectively, **pole-type capacitors and capacitor assemblies** as used by utilities for power-factor improvement. Bulletin 8145 covers individual pole-type capacitors for outdoor service, 60 cycles. Bulletin 8148 covers outdoor capacitor assemblies, three-phase, 60 cycles, with both in-line and cluster as well as contour types of pole-mounted racks being described.

Write B-239 on reply card, pg. 17

Ultra-compact, **packaged electrical substations** which slash overall requirements by as much as 53 per cent in size and 40 per cent in floor area are described in a new bulletin just published by **I-T-E Circuit Breaker Co.**, 1900 Hamilton St., Philadelphia 30, Pa. The eight-page two-color bulletin furnishes information on I-T-E's new line of highly compact Tranfo-Units, in ratings of 75 through 500 kva, for such installations as schools, hospitals, airports, shopping centers, office buildings, and light industrial areas.

Write B-240 on reply card, pg. 17

Jay Lighting Manufacturing Co., 5 East 35th St., New York, N. Y., manufacturer of **incandescent lighting fixtures**, has just issued a 12-page supplement that illustrates and describes the newest additions to the hand-crafted Coronet series. This brochure is called "Coronet Series II."

Write B-241 on reply card, pg. 17

The Centriline fan, an airfoil **centrifugal fan** with in-line air flow, is discussed in a new 14-page catalog available from the **Westinghouse Electric Corp.**, Dept. 355, Hyde Park, Boston 36, Mass. A recent addition to the company's line of ventilating equipment, the Centriline fan has the high efficiency characteristics of a centrifugal fan, yet requires less than half the installed space. The booklet is illustrated with photographs, construction and installation diagrams, performance curves, and tables. It includes sections on construction features, optional accessories, installation arrangements, and notes on specifying and applying the fan.

Write B-242 on reply card, pg. 17

Ettco Wire & Cable Corp., 46-50 Metropolitan Ave., Brooklyn 37, N. Y., has just published an illustrated 24-page catalog of its **wire and cable products.** Besides descriptions of all Ettco products in easy-to-find forms, there are pertinent tables and specifications relating to various kinds of conductors.

Write B-243 on reply card, pg. 17

Lighting units for industrial assembly, sign boards, and gymnasiums are a few of the many varieties of lighting units offered in the new **industrial incandescent lighting** catalog, bulletin "G", just published by **Benjamin Division of Thomas Industries, Inc.**, 207 E. Broadway, Louisville, Ky. The 32-page catalog diagrams and describes units for general lighting and specific industrial needs.

Write B-244 on reply card, pg. 17

To mark the introduction of the most powerful and inclusive building products line in its history, **Progress Manufacturing Co.**, Castor Ave. and Tulip St., Philadelphia 34, Pa., is distributing its new **building products** catalog. "Exploded views" detail the many features of the Progress building products line. Included in the catalog are bathroom cabinets, range hoods, exhaust fans, and home radio-intercoms—priced for project or cus-

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"NOB" STAPLES
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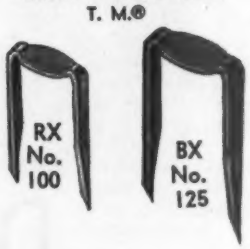

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General Sales Agents _____ J. J. WALSH COMPANY _____ Greenville, R. I.

tom homes. The catalog tells the full story of more than 85 different models.

Write B-245 on reply card, pg. 17

A new, illustrated, 16-page descriptive booklet on electric **furnace transformers** has just been released by **Pennsylvania Transformer Division,** McGraw-Edison Co., Box 330, Canonsburg, Pa. The multi-colored booklet (No. PFT3M960) includes a review of the basic design principles applied to transformers with high-current ratings, as well as construction details and principal accessories. Both internal and external features are illustrated by photographs and drawings. Materials and manufacturing processes are described.

Write B-246 on reply card, pg. 17

A new 84-page catalog illustrating over 1500 electrical **wiring devices, lamps, and specialty products** has just been released by **Eagle Electric Manufacturing Co., Inc.,** 23-10 Bridge Plaza South, Long Island City 1, N. Y. Showing the largest and most complete line in its almost 40 years, Eagle has added many new products this year. Among the electrical products featured are approved specification-grade electrical wiring devices, switches and receptacles, transformers, extension and cord sets, fuses, wall plates, push buttons, and lamps.

Write B-247 on reply card, pg. 17

Bulletin GEA-6578A, eight pages, describes the line of **static control** of the **General Electric Co.,** Schenectady 5, N. Y. Pictures and diagrams show how G-E static control components simplify panel design and operation. A close-up photo shows the G-E logic element, heart of the static control logic system. A cutaway photo shows panel construction while other pictures illustrate the ease with which circuit designs may be checked in advance and ease of wiring and installation.

Write B-248 on reply card, pg. 17

The new 32-page illustrated catalog just issued by **Stonco Electric Products Co.,** 333 Monroe Ave., Kenilworth, N. J., includes photographs, specifications, and dimensions on their entire cast aluminum line of high-efficiency incandescent and mercury vapor sealed beam **floodlights and clusters,** 200-500w long-throw power-beams, emergency portables, vaportight pendant, ceiling and wall fixtures, and weatherproof wiring troughs, splice boxes, and floodlight fittings.

Write B-249 on reply card, pg. 17

I-T-E Circuit Breaker Co., Dept. A-4, 1900 Hamilton St., Philadelphia 30, Pa., has announced publication of a comprehensive bulletin on its custom-designed, **liquid-filled substation transformers.** Range of substation transformers covered by this 16-page, two-color bulletin is single- and three-phase, 501 to 10,000 kva, and up to 69 kv. Standard features illustrated and described include tanks; core and coil assemblies; instrumentation; controls, and standard and optional accessories.

Write B-250 on reply card, pg. 17

Speedbus, a new 100-ampere **packaged busway** for installation in industrial and commercial buildings, is described and illustrated in a catalog produced by **National Electric Division, H. K. Porter Company, Inc.,** Porter Bldg., Pittsburgh 19, Pa. Construction features of the new busway are shown and suggested applications are listed. The new catalog also contains complete dimensional data, catalog numbers, and price information for Speedbus and available components.

Write B-251 on reply card, pg. 17

Two new bulletins fulfill a need for information about equipment and practices for **high-voltage distribution.** Bulletins 60118 and 60119 are now available from **Line Material Industries,** McGraw Edison Co., Milwaukee 1, Wis. These bulletins illustrate equipment especially designed for 20/34.5-kv distribution systems as well as typical construction drawings employed by several major utilities.

Write B-252 on reply card, pg. 17

Adapting **photocontrols** to any commercial outdoor lighting fixture is simplified with a new 24-page data file just released by **Precision Multiple Controls, Inc.,** 233 Chestnut St., Ridgewood, N. J. Well illustrated, the booklet describes tubeless controls with locking type receptacles prescribed by NEMA standards, along with mounting accessories for adapting photoelectric 'automation" to all poles, cross arms, pole tops, and pendant and old-style fixture heads.

Write B-253 on reply card, pg. 17

An eight-page publication describes the full line of **reduced-voltage starters** of the **General Electric Co.,** Schenectady 5, N. Y. The illustrated bulletin describes the reduced-voltage starter and its use and contains a selection and comparison table covering the various types of starters. The publication also discusses the operation and application of General Electric's manual and magnetic autotransformer starters, part winding, primary resistor, and the new wye delta starters.

Write B-254 on reply card, pg. 17

Primary electric heat system distributors, architects, contractors, and engineers will find a new "heat computer" offered by **Arvin Industries, Inc.,** Columbus, Ind., of great help in figuring **heat loss and cost** for elec-

NONE BETTER than KNOX
WIREHOLDERS
The No. 5009 has been designed to satisfy the most critical requirements — metal parts in tension and porcelain in compression. All steel parts are HOT-DIP GALVANIZED. The Porcelain has been designed with well-rounded edges and provides a larger, pulley-action wire hole. The spun solid copper rivet interlocks the insulator with the metal portion of the Wireholder. Extra sharp screw thread for easy starting and full threaded. The heavy screw-shank base offers high resistance to side pull. KNOX No. 5009 Wireholders far surpass recommended ratings on standard house service conductors. This Wireholder can also be supplied with 22 x 3" and 22 x 4" Screws.
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No. 418 HEAVY DUTY
KNOX has numerous styles and types of Porcelain Wireholders.
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trically heated homes and other buildings. The booklet shows wattage loss for six significant areas: windows, doors, walls, ceilings, floors, and by infiltration. It also contains charts showing outside design temperatures throughout the country and an annual degree-day map. Accompanying the computer is a booklet which gives detailed instructions for its use.

Write B-255 on reply card, pg. 17

A new, 40-page catalog has just been published by **R. Frank Advertising Specialties, Inc.**, 253 Center St., Williston Park, N. Y., containing detailed information on more than 250 proven **gift items** ranging from inexpensive specialties with company imprinted advertising messages to fine executive gifts. The new catalog is fully illustrated and contains prices for both single and quantity purchases on all items designed to meet every taste and every price range.

Write B-256 on reply card, pg. 17

A handy pocket catalog of electric **motor controls** has recently been released by the **Furnas Electric Co.**, 1064 McKee St., Batavia, Ill. The bulletin contains 56 pages of descriptions, ratings, and prices for manual and magnetic starters, drum controllers, pressure, foot and limit switches. Also included are push buttons and related pilot devices. Motor ratings and heater coil data, plus simplified tables make control selection easy. The catalog is designed for quick and easy reference.

Write B-257 on reply card, pg. 17

Wheatland Electric Headerduct cellular **floor feeder raceway** is the subject of a new catalog just published for electrical contractors, engineers, and architects by **Wheatland Electric Products Co.**, 500 Logan St., Carnegie, Pa. The new catalog contains product illustrations and detailed information for specifying and installing Wheatland Headerduct and service fittings.

Write B-258 on reply card, pg. 17

Chromalox far-infrared electric **radiant comfort heaters** are the subject of a four-page bulletin, F70100-2, now available from **Edwin L. Wiegand Co.**, 7500 Thomas Blvd., Pittsburgh 8, Pa. The pages are devoted to illustrations, application information, features, and specification data.

Write B-259 on reply card, pg. 17

SNAP!
THEY STAY ON.....
All VICTOR "MAGIC" CLAMPS and STRAPS for Thin and Heavy Wall Conduits have this time-saving snap-on feature.
Contractors everywhere are switching to VICTOR. Cash in on this heavy demand. Add these fast selling, profitable Clamps and Straps to your line.
Write for the new Victor Strap Catalog. Lists over 600 items to fasten Wire, Cable, Tubing and Conduit.
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Loading transformers

(Continued from page 78)

within the changeout range shown, the annual cost/kva decreases with higher changeout loads. Curve B, on the other hand, indicates what happens when life is considered. Note that shortly after a changeout criterion of 160 per cent peak load is reached the costs shoots up. This is significant and shows that life should definitely be a factor in formulating a distribution transformer loading policy.

With some of the newer insulation systems now available, transformers can be loaded greater with no sacrifice in life expectancy. It would appear advisable, therefore, to increase the loading on these new distribution transformers insofar as economics and voltage limitations permit.

In Fig. 5, Curve A shows the average annual operating cost in $/kva of load served for all these transformers (10-100 kva) when life is not considered. Curve B again shows what happens when life is considered on this "base" transformer, a unit with the insulation system defined previously. Curve C is for one of the new insulation systems.[3] Note the continuing decrease in operating costs.

Whereas Curve B jumps up when the load passes about 160 per cent, Curve C does not take the jump until after 180 per cent loading. The two "minimum points" are approximately $3.29 and $3.37, or a difference of $.08 per kva of load served per year.

This figure, multiplied by the sum of each transformer annual peak load kva on the system, will give the potential savings per year which could be attained by a change in loading practice. As loads grow, of course, the system savings become even larger.

A distribution transformer loading policy based on economics can mean real dollar savings to the utility. It is recognized that other factors must be considered in setting up a loading practice, such as the very practical question of how to keep track of individual transformer loading. This question has been the subject of many industry papers, however, and no attempt is made to discuss it further here.

Our objective here is to indicate to the electric utility some of the rewards to be gained by establishing a distribution transformer loading policy based on economics.

References

(1) A. J. Stegeman: "Ninth Annual Electrical Industry Forecast," Electrical World, September 22, 1958.

(2) C. F. Mitchell, J. O. Sweeny, J. L. Cantwell: "An Economic Analysis of Distribution Transformer Application," AIEE Transactions Paper No. 59-783, March 23, 1959.

(3) M. F. Beavers, E. L. Raab, J. C. Leslie: "Permalex - a New Insulation System," AIEE Conference Paper No. 59-952, June 26, 1959.

Safe driving

(Continued from page 71)

erected the first "one way" signs. In our own country the early pioneers of Rhode Island put up signs which read "No Speeding" to prevent horse drawn vehicles from galloping wildly through their streets.

In all ages, however, the basic purpose of traffic signs has been the same, to protect, to guide, and to help the traveler. Yet they only help the motorist who heeds them. They are "signs of death" to those who fail to use them.

Remember, there are five basic types of signs found on our highways today: the octangular or stop sign, round or railroad crossing sign, rectangular or information sign, diamond shaped or reduce speed sign, and the old familiar cross buck which marks the site of a railroad crossing.

Vehicles used for transporting explosives or inflammable liquids must be marked on each side and the rear with the word "explosives" in letters not less than six inches high and must display on the rear of such vehicle a red flag not less than 24 inches square marked with the word "danger" in wide letters not less than six inches high. This, too, is a factor

which should be complied with from the standpoint of courtesy, as well as safety.

Fifty million automobile drivers, some good and some bad; three and one-half times that many pedestrians including the young, the old, the lame, the halt, and the blind; more than 40,000,000 automobiles, some new, some old, and many ready to fall apart; 3,000,000 miles of highways, many of them laid out for oxcart travel; a dozen hazards in every mile—add all of these together and you have America's traffic picture. A complex game of life and death in which each of us must have a hand.

In this grim game of showdown each one of us holds at least two trump cards that can help to keep us and others among the living. First, let's resolve to keep a healthy, courteous, reasonable, even-tempered *attitude* towards the traffic laws and regulations made necessary by our overcrowded highways. Second let's adopt *defensive driving* as a way of life on the open road, on our busy city streets, or even in our own driveways.

These two thoughts, when firmly implanted in our hearts, our minds, and our consciousness, may serve as our most valuable weapons in the determined fight for safety on America's highways.

Lightning arresters

(Continued from page 69)

tween the arrester protective level and the equipment BIL, and the current magnitudes that the arrester is expected to discharge.

If the original assumptions were on the basis of an unshielded circuit, then the desired degree of protection possibly may be obtained by shielding the circuit against direct strokes.

One consideration in the choice between intermediate- and station-class arresters is the switching surge duty to which the arresters will be subjected. Intermediate arresters are not capable of absorbing the switching surge energy that station arresters can withstand. The intermediate arrester, being of lower cost design, cannot be constructed to have the capability of the station arrester.

Factors that affect the switching surge duty on arresters are:

(1) Length and operating voltage of the connected lines;

(2) Cables and capacitor banks connected to the system;

(3) Current interrupting characteristics of breakers and load-break switches; and

(4) Operating sequences when energizing and de-energizing lines.

Intensive study is being carried on by AIEE and NEMA committees in regard to the switching surge duty of arresters. Attempts are being made to devise a realistic test that will indicate the comparative capabilities of station- and intermediate-class arresters. When this work is completed the system characteristics, for which the two classes of arresters can be recommended, will probably be defined.

The best protection for equipment is obtained by locating arresters at the equipment. In substations a number of pieces of equipment may be protected by the same arrester. Locating arresters at each piece of equipment is not economically justifiable. A question then arises as to how far an arrester can be separated from the equipment and still obtain the desired degree of protection.

When an arrester is located at a distance from equipment, the voltage at the equipment can rise above the voltage level maintained by the arrester. The fundamental concept of this overvoltage is explained by the diagrams of Figure 3.

These diagrams show an arrester and transformer separated by a length of bus, the equivalent circuit diagram, and the voltage waves at the arrester and transformer. The lightning arrester is represented as a generator because during current discharge it produces a discharge voltage.

The bus bar between the arrester and the transformer represents a self-inductance L. The transformer, during the first few microseconds of a surge, acts very much like a capacitor of several thousand micromicrofarads.

The voltage produced by the arrester is represented as a square wave. As the voltage across the arrester rises, the capacitor tries to take on a charge. The current required to charge the capacitor must flow through the inductance of the bus, which causes the capacitor voltage to lag behind the voltage of the arrester. When the voltage at the arrester reaches crest value, the stored energy in the inductance of the bus causes

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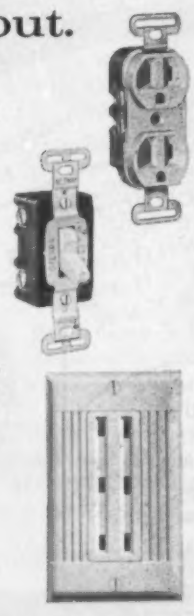

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the capacitor voltage to "over shoot" as shown.

This explanation is extremely simplified. The circuit and an actual substation are far more complex. A number of pieces of equipment in the substation constitutes several parallel capacitive branches in the circuit, with inductance of the bus between each capacitive branch.

Recommendations for separation distances in substations have been worked out on analog computers and are available in various industry literature.

Complex substations having a number of transformers, multiple lines, and high-voltage buses generally require individual study. The cost and importance of such substations, however, readily justify such studies.

Stations that are not adequately protected by one set of arresters, because of separation distances between the arrester and some equipment, may be protected adequately and more economically by using two sets of intermediate-class arresters in place of a single set of station arresters. No universal rules can be given for a choice between the two types of arresters. The choice must be based on a study of each individual substation.

Lightning protection for substations during the past 20 years has progressed into a science. The science, however, is still far from exact. A great number of unknowns and unknown probabilities that require considerable judgment still exist. Such judgment must be based upon experience and, to some degree, upon the operating philosophy of individual utilities.

Basic impulse levels

(Continued from page 67)

lator, 425-kv BIL; 110-kv wood pole, H-frame, 1,200-kv BIL; 230-kv steel H-frame, 1,425-kv BIL. All have overhead ground wire and counterpoise or driven ground rods. An interesting observation is that all three have practically the same level of lightning performance.

The 44-kv line costs approximately $10,000 per mile; the 110-kv line using the same conductor costs $13,000 per mile, or approximately 250 per cent more BIL for 30 per cent more money. The 230-kv line with 795-mcm conductor costs $26,000 per mile; a 110-kv line using the same conductor costs $16,500 per mile, or 20 per cent more BIL for 60 per cent more money.

The comparison between the 110-kv and 230-kv lines is not completely fair, since the 230-kv line is steel construction and consequently requires much less maintenance. However, when making an economic comparison, the actual cost of increased BIL is interesting.

Since the line BIL in use is somewhat related to operating voltage and directly affects construction costs, the following is an interesting comparison: Assuming a 44-kv line can transmit 10,000 kva, the line cost is $1.00 per kva per mile; with line capacity varying as the square of the voltage the 110-kv line cost is 20.8¢ per kva per mile, and the 230 kv 9.5¢.

Any bold attempts at major BIL reduction at extra high voltages should be taken cautiously, in view of the behavior of some EHV lines. There do not appear to be any major problems at lower voltages.

An interesting observation to the extreme in line BIL reduction, is a 115-kv line of approximately ten miles length which has the top phase insulated for 695 BIL, and the two bottom phases insulated for 450 BIL. It is located in an area which has an average of 20 thunderstorm days per year. The line is said to be obviously underinsulated; however, it is reported to have a good operating record.

(A second article on substation BIL will appear in the March issue.)

Code application

(Continued from page 41)

Section 500-1 states, in part, "It is intended that each room, section or area (including motor and generator rooms, and rooms for the enclosure of control equipment) shall be considered individually in determining its classification. . . ."

Once the classification has been established, however, it is possible sometimes, as suggested in the fine print note following Section 500-1, to either install some of the equipment, such as lock-type disconnect switches, outside of the area and save on costs in that way, or to either eliminate or reduce in extent the hazardous area by positive-pressure ventilation.

Such ventilation, to be acceptable, must be adequate to remove all hazards and so interlocked that a failure or a reduction in its effectiveness would automatically disconnect current to the area. The majority of hazardous conditions, of course, could not be eliminated by ventilation.

Wiring and equipment which is intrinsically safe by reason of its having insufficient electrical power, even under abnormal conditions, to cause ignition is not required by the Code to comply with the special rules which apply to other electrical equipment in hazardous areas.

Answers to Code test questions: (1. **T** Section 470-1) (2. **T** Section 470-8) (3. **F** Section 480-2) (4. **F** Section 480-4-e) (5. **T** Section 480-7-a) (6. **b** Section 470-6) (7. **a** Section 470-3-c) (8. **c** Section 470-3-b) (9. **c** Section 480-7-d) (10. **b** Section 480-7-f).

Success factors

(Continued from page 33)

Keeping an inventory of materials on hand, our men do not have to run to the supply houses to get materials. An ordering system through the shop keeps all jobs supplied with materials as they are needed.

We list all materials needed for each phase of a job. Knowing what materials will be required

for certain types of work, we move enough out for one or two weeks. This eliminates loss or damage on a site when materials are not ready for use.

Planning ahead through constant checking on a job also means stocking profitably. Foresight and preparation for jobs for the next 30 - 60 days through ordering enough material is the key to profitable new construction. We maintain a list of all stock carried.

Since we preplan, we make a list of materials that we shall need from job orders. Preplanning avoids running into any shortage difficulties. We usually order between the 20th and the 25th, indicating delivery the first of the month. We still have an excess of stock until the new supply comes in.

Our stockroom is planned and laid out from the viewpoint of greatest accessibility and most economical use of space. Each bin and shelf is clearly marked with the name and size of the item it holds, with related items for a job being grouped together. Bins for small fittings from one-half to three inches are located in a series of shelves with size indications marked vertically. Varied types of fittings within the same sizes are arranged in bins horizontally.

Large size bins along the next aisle holds switches, receptacles, plates, etc. Boxes take another aisle of bins. Racks for cable and wire were built to size for the amount of stock carried. Panels and lighting fixtures are housed in another section of the stockroom.

The stockroom is accessible to only three persons, a practice contributing to better stock control. As an order is written out for each job, materials are set out and checked off. All material is charged up to a job and this record is placed in the job folder with job labor records.

When you hear electrical contractors shying away from new construction or shrugging it off as ruinous, they have failed to buy efficiently and to devise efficient labor control. For instance if you place a mechanic unaccustomed to residential jobbing at this job, your labor costs become excessive.

Our job foremen detail each man on a job. Working in crews, mechanics know where to move when they get through with a job, so that the crew behind them can start their work.

Our estimates, as with most contractors, are based on labor, materials, and permit costs on each job. However, here is where we may differ from other operations. We predetermine what our profit on a job should be, computing our operating overhead costs before we arrive at that profit.

If all fixed items, like rent, supervision, office, maintenance, etc., are taken into consideration, you do not come out of jobs at the end of the year wondering why you made it so close.

Dairy plant wired

(Continued from page 34)

tions will want to know the thinking behind these jobs. Incidentally, dairy farmers, particularly from the West Coast, have made several trips to Fabens to study this layout. It's modern, practical, and labor-saving.

For example, in the milking parlor with eight stalls, the attendant has only two toggle switches to manipulate—one to start the vacuum pump, and one to start the circulating pumps. From there, everything is automatic. As a consequence, two attendants milk 500 cows twice a day, and the capacity is 650 cows.

Magnetic starters are used throughout. One line is for milk pumps, pulsator, and agitator; the second line is for on and off controls for compressors; the third line controls vacuum pumps and an added compressor; and the fourth is interlocked with all four compressors.

None of the nine installations are exactly alike, since the refrigeration equipment is set up to take care of the particular situation—hence, the close cooperation with the refrigeration engineer.

E. L. Schmidt, field superintendent of the Borden Co., who helped set up these nine dairy farms, explained the reason for this type installation: "The dairy business is highly competitive. Electrical devices must be employed to keep the labor situation under hand, and give us better quality control of the milk."

Milk is a delicate commodity, and when frozen it loses some of its flavor. That is one reason why this farm's milk is cooled by aeration, rather than dumped in a storage tank where warm milk is added to the cold. Too, chilling milk by aeration rids the milk of certain gases, resulting in higher quality milk.

The aerator is eight feet long, sweet water cooled, and of stainless steel. The temperature has to

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be held one to two degrees above freezing, and at the same time not freeze, regardless of the amount of milk being chilled. The aerator consists of two eight-foot sections, with a one-hp centrifugal pump per section. There is also a ten-hp unit on the top section, and a five-hp unit on the bottom section.

"Working without plans," said Mr. Hodges, "was no great handicap. The job went off smoothly, with our men working outside when there was no inside work hooking up the equipment. The entire 14-acre area, split up into corrals for 40 cows each, is lighted. This is all underground flood lighting, for which we used direct burial wire, with 200 outlets."

Working without plans, there were no costly changeovers to consume time. "Every detail just fell into place," Mr. Hodges concluded.

Code questions

(Continued from page 32)

(52) **Question:** How many inspection authorities are now enforcing NI circuit breaker requirements?

Answer: By a show of hands, most of them have delayed enforcement until January, 1961.

(53) Section 210-7. This section states that a grounding type receptacle is required by section 250-59, after close scrutiny I fail to find anything requiring a receptacle.

Question: Is the reference in 210-7 correct?

Answer: Yes. Section 250-59 is based on the assumption that the equipment referred to is provided with attachment plugs.

(54) **Statement:** Where two wire cords and attachment plugs are supplied on gas ranges for clocks, timers, lights, etc., the screw shells of the sockets are energized when the attachment plugs are in one position.

Question: What, if anything, is being done to require manufacturers of this equipment to provide cords and attachment plugs with facilities for grounding?

Answer: The gas industry has been requested to provide grounding type cords and plugs.

(55) **Statement:** A three-phase 440-volt installation uses aluminum conductors, with open wiring on insulators, each conductor is loaded at 250 amperes. Insulators used are steel of the three-spool type, conductors are run on the back side of the insulators, each conductor is surrounded by the steel enclosure of the rack, and such racks fastened to a steel structure.

Question: Will such an installation result in heating?

Answer: Yes. The same would be true, however, if copper conductors were used.

(56) **Question:** When will U.L. be in a position to start listing service entrance switches and fuses in the range to 6,000 amperes and when will U.L.-labeled fuses in that range be available?

Answer: Approximately one year. Development of standards is now in process.

(57) **Statement:** Outlet boxes for use with non-metallic cable. What methods are contemplated to effectively connect three or more equipment grounding conductors together within and to the boxes.

Question: Are holes available with ground bus and multiple connections?

Answer: It is suggested that pressure type connectors be used for two or more wires and leaving a tail, or extended wire, for connection to the box or grounding clip as manufactured by some manufacturers.

(58) **Statement:** The panel chairman on grounding, for the telephone industry, states a requirement for a small plate containing "Do not Remove."

Question: Would this be effective and could it be a requirement of the NEC?

Answer: Would probably not be any more effective than present methods, when piping is removed for replacement or other reasons it is very probable that the tag or plate will not be attached again.

Aluminum installation

(Continued from page 31)

Sales, Inc., through Westinghouse Electric Supply Company of Miami. Melvin Grossman was the architect; Sasnett Engineering Company did the electrical and mechanical engineering.

Contractors need help

(Continued from page 29)

down. I would think up and hunt up other items of interest to the contractors. Then, I'd put out a mimeographed folio once a month to all of my contractor-customers —serve it with the coffee!

These monthly meetings would turn out to be so interesting and profitable to my customers that I'd have to shift them from my office to my warehouse, within six months, to accommodate the crowd. And about that time a lot of manufacturers' representatives would want to route themselves to my town on that Saturday to display some of their wares—maybe two or three at a time—and their bosses would add sandwiches to the coffee, too!

In my program I'd have a great big black book. I don't know where to buy a blue one but I'd call this the "Blue Book." It's purpose would be to avoid "the blues"! It would be indexed alphabetically. Everybody on my customer list would have a chance to add an entry to the book—those entries would be the names of unsatisfactory wiring customers.

Here's how it would work. Small Contractor X has a customer who cheated him somehow, or at least made the dealing very unsatisfactory. This customer's name would go in the book along with Contractor X's name, and the date —no other information. Later on if another contractor wanted credit or other information on this unsatisfactory customer he could consult the book and go see Contractor X. This sort of information exchange should work better than any credit bureau because it would

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As emcee of these informal meetings, I'd get under the skin of my contractor-customers and make them loosen up and help each other with information, suggestions, and ideas. We would develop a team spirit up to a certain point even though competing for business, because no one is so smart that he cannot learn something to his advantage. Everyone would have to give.

The mimeographed bulletins would show a lot of reasons why inspectors turned down various wiring jobs. Every one of my customers could learn of these causes, then avoid making such errors and thus increase efficiency.

A question and answer period would help the whole group. Some of my contractors would have practically no questions, because of their long experience, but those men would benefit also. Their ego would receive a big boost through their opportunity to display their knowledge by answering many questions.

And lastly, I'd put up a suggestion box and secure ideas for making these meetings so attractive that I'd have a lot of my out-of-town contractors' and some of my in-town contractors' men coming to meetings. And when the word got around I'd have some new customers at the city desk!

Lightning protection

(Continued from page 29)

flow of power current which attempts to follow the path established by the high voltage discharge.

Since the combined elements of the arrester constitute a nonlinear resistance (one in which resistance is very high at normal circuit voltages, becoming low at high circuit voltages), it is able to perform these two functions time and again without damage to itself.

Installation of this type arrester is fast and simple. They can be mounted in a variety of positions at the cut-in or the distribution panel. It is extremely important, however, that the path to ground be checked on every job. The grounding conductor must be of the proper size and solidly connected with the earth.

The following are direct quotations from the 1959 NEC concerning the installation of lightning arresters:

"250-131. On Secondary Services, 750 Volts or Less. Where a lightning arrester is installed on a secondary service, the connections to the service conductors and to the grounding conductor shall be as short as practicable. The grounding conductor may be (1) the grounded service conductor, (2) the common grounding conductor, or (3) the service equipment grounding conductor. The bonding or grounding conductor shall be of copper not smaller than #14 or equivalent corrosion-resistant material."

"280-23 Connections—Size and Material. The connections between the arrester and the line wire or bus, and between the arrester and ground shall be of copper wire or cable or the equivalent, and, except as provided on secondary services in Section 250-131, shall not be smaller than #6 and shall be made as short and straight as practicable, avoiding as far as possible all bends and turns, especially sharp bends."

The reliability and safety afforded by lightning arresters is totally dependent upon the availability of a low impedance path to ground.

Practically every home is a potential market for lightning protection. The fact that a home is insured against lightning damage does not lessen the need for arrester protection, since the loss of a major appliance or damage by fire is most inconvenient and disconcerting even if all losses are absorbed by the insuring company.

Indeed the thinking homeowner can hardly afford to turn down this low cost protection and the progressive electric contractor certainly can't pass up the opportunity to provide a genuine service to his customers, while opening a large market to himself.

Wiring storage area

(Continued from page 27)

Recently, there was a proposal to build a big city-owned underground storage garage in connection with a city auditorium. Intensive surveys were made to see what other cities had done. San Francisco and Chicago developed extensive underground storage of cars without too much restriction. Their surveys failed to find any evidence of explosions or fires in any such installations. It seems to be the opinion that if there is a danger of explosion it is more

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likely to come from a backfire of an automobile or a cigarette.

But the experiences of the fire prevention service of the city do not justify any costly electrical installations. The records tend to show that the severe fires and explosions in residences generally come from the use of highly vaporous gases from cleaning fluids which are set off by the pilot light of hot water heaters or furnaces. Actually there are no fixtures of any kind that are or will remain non-explosive.

If you have an approved explosion-proof fluorescent fixture, it will remain as such until someone takes off the protective glass and leaves the naked tube ready to start an explosion.

Obviously history does not justify the present constrictions of the National Electrical Code, so effort should be made to get the Code revised. In the meantime keep your eye on the plans and specifications before submitting your bid.

Utility substation

(Continued from page 26)

Closer supervision is also necessary, in order to provide safety for the men, as well as to prevent damage to the equipment.

On jobs where plans and specifications are not supplied, we draw our own plans, before starting the job, but often plans are supplied to us.

One of the large jobs we did recently was at the new service center built at the edge of Knoxville by the Tennessee Valley Authority. The buildings there include a modern garage, 28,414 square feet in area; power stores, 16,800 square feet; power construction, 39,800 square feet; system maintenance, 13,264 square feet; and system maintenance shed, 4,453 square feet.

Incoming voltage is 13,800. The outdoor distribution center and transformer station is fed overhead from the Knoxville Utilities Board primary terminal pole and metering. The substation feeds a group of four buildings. Lines feeding the main garage and repair center for trucks and heavy equipment were laid underground for about 240 feet.

The buildings are electrically heated except for two office sections which have Weathertrons with supplementary electric heat.

All switches in each building are marked to show what they feed and from where they are fed.

Of the three transformers on a concrete platform just outside the garage and repair center, two are 100 kva and one is 167½ kva. They have special junction boxes to enclose primary and secondary terminals for pad or concrete insulation. They are connected delta delta with the 167½ kva furnishing the lighting load. This arrangement gives full voltage for motor operations as well as for lighting.

Economic comment

(Continued from page 4)

quite thoroughly and question all governmental programs that may tend to reduce the freedom of the economy and more particularly the freedom of the individual to vote in the market place as an American consumer.

Government spending, in whatever guise it is offered, tends to make the government a competitor in the market place and directs the manner in which production will be carried on. Moreover, the size of government spending makes it a serious competitor for the American consumer in modern-day economics.

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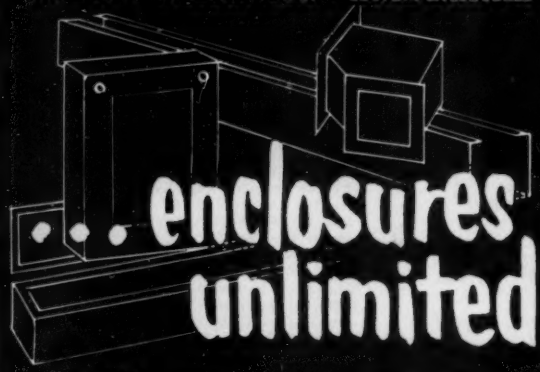

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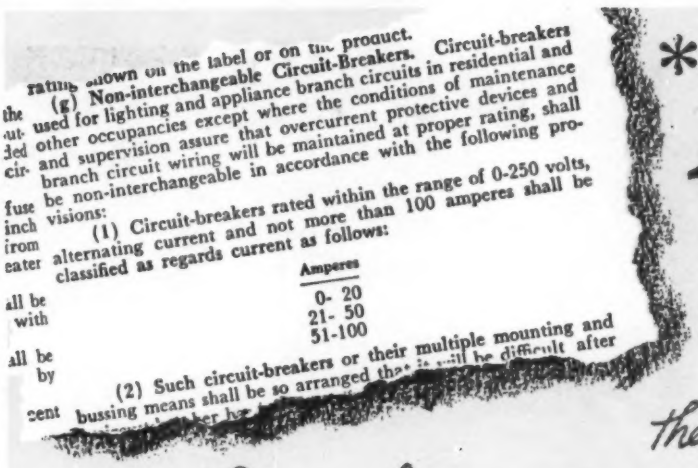

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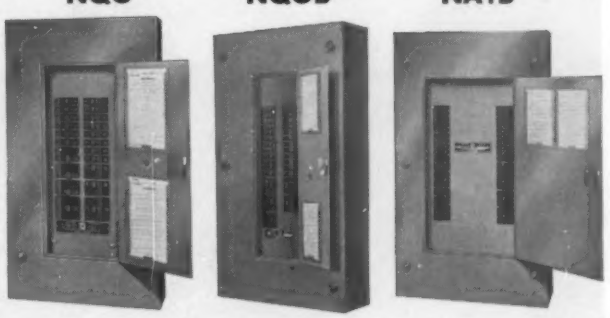

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